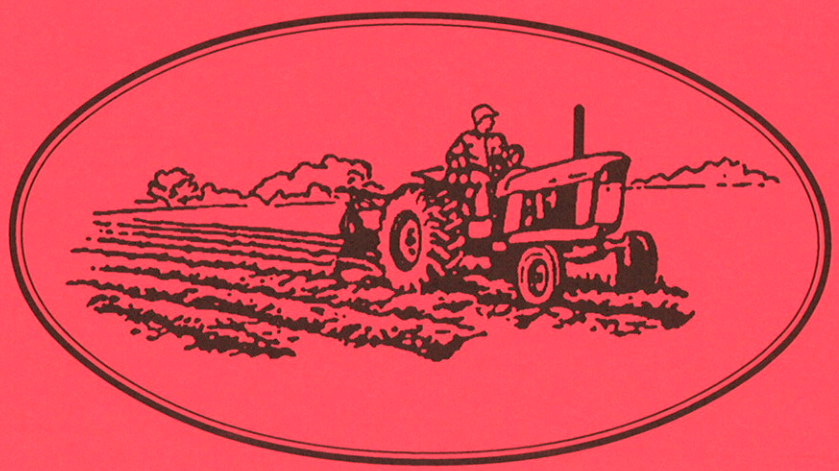
SEVENTEENTH
ANNUAL

REPORT NO. 17

WESTERN DAKOTA

CROPS DAY
RESEARCH REPORT



HETTINGER ARMORY
DECEMBER 14, 2000

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17th Annual Western Dakota Crops Day
December 14, 2000
Hettinger Armory

MST

9:00 am Registration
Coffee and doughnuts. Free time to view exhibits and visit with Ag. Industry Program Sponsors.

10:00 Earlybird Drawing

10:30 Opening Announcements

10:45 Crop Variety Updates and Highlights of Ongoing Crop Production Research

Roger Ashley, Extension Agronomist, Dickinson

Pat Carr, Agronomist, Dickinson Research Extension Center

Eric Eriksmoen, Agronomist, Hettinger Research Extension Center

12:00 Lunch
Provided by Program Sponsors. Free time to visit with sponsors.

1:00 Ag Industry Update

1:45 Profitable No-till Systems
Dr. Dwayne Beck, Dakota Lakes Research Farm, Pierre, SD.

3:00 Conclusion
Drawing for door prizes, coffee and opportunity to visit with sponsors.

Acknowledgments

The Hettinger and Dickinson Research Extension Centers gratefully acknowledge and thank the following companies and organizations for their financial support and participation in this year's Western Dakota Crops Day. Those listed below have provided for the noon meal and have sponsored the event in total. We thank them for their commitment and support.

2000 Western Dakota Crops Day Sponsors

Hettinger Chamber of Commerce
Interstate Seed
Hettinger Farmers Union Oil
Croplan Genetics
National Sunflower Association
Pioneer Hi-Bred
Northern Canola Growers Assoc.
Scranton Equity Exchange
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Howe Seeds
Syngenta

We also acknowledge and thank the following individuals for their willingness to cooperate with us at off-station plot sites and in providing us with materials for this publication. Their participation has enabled us to compile the enclosed information which would not otherwise be possible.

Daryl Birdsall, New Leipzig
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Dave Bertelsen, Wibaux Co. Extension Service
Roger Ashley, Dickinson Res. Extension Center
Amy Dukart, NDSU Extension Summer Intern

We also thank area County Extension Services and area County Crop Improvement Associations for their financial assistance in the printing costs of this publication.

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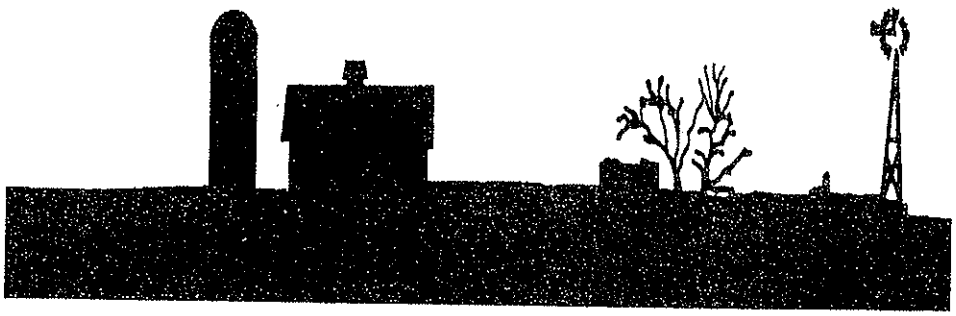
Profitable No-till Systems Designed for Producers in the North American Great Plains and Prairies.

Dwayne L. Beck, Ph.D.
Dakota Lakes Research Farm
South Dakota State University



Interpreting Statistical Analysis

Field research involves the testing of one or more variables such as crop varieties, fertilizers, tillage methods, etc. Field testing of such variables are conducted in order to determine which variety, tillage method, or fertilizer etc. is best for the particular area of production. The main objectives of crop production research are to determine the best means of producing the crop and how to maximize yield and economic return from farming.

Agricultural researchers use statistics as a tool to help differentiate production variables so that real and meaningful conclusions can be drawn from a relatively large amount of data.

One of these tools is the Coefficient of Variability (C.V.). This statistic gives an indication of the amount of variation in an experimental trial and is a measure of the precision or effectiveness of the trial and the procedures used in conducting it. Attempts are made to control human error and some environmental conditions such as soil variability by replicating the variable in question. For example, there were four plots (replications) of the variety 2398 grown in the Hettinger HRSW variety trial. The plots are mixed and dispersed throughout the trial to help eliminated differences that might be a result of soil or other variations. The numbers that you see in the tables are an average of all four replications. The C.V. for yield in the 2000 Hettinger HRSW trial was 6.7% meaning that there was an 6.7 percent average variation between high and low yields among replications. In summation, a trial with a C.V. of 6 is more precise and more can be concluded from it than a trial with a C.V. of 16.

Another important statistical tool is the Least Significant Difference or LSD. If the yield of variety A exceeds variety B by more than the LSD value, you can conclude that under like environmental conditions, variety A is expected to significantly out-yield variety B. The LSD value allows you to separate varieties, tillage practices, or any other variable and determine whether or not they are actually different. The LSD 1% value is always larger and gives you more precision than the LSD 5% value. Little confidence can be placed in variety or treatment differences unless the results differ by more than the LSD value.

Growing Conditions
Hettinger Research Extension Center
2000

The winter of 1999/2000 will go into the history books as being warm and dry. The average temperature for the month of November was 41 degrees vs. the 45 year average of 30. The daily high temperature was above 32 degrees every day in November and for the first 16 days of December. Soil frost set in during mid-December, however, frost levels were shallow throughout the winter and went out during late February/early March. Temperatures were generally mild throughout the winter months and there was no period of bitterly cold. Reports of volunteer spring wheat survival through the winter were common. Dormant seeded canola planted at the end of October and the early part of November sprouted resulting in very poor spring stands. The dry winter also resulted in short grass and first cutting alfalfa.

Field work began in mid-March with relatively warm and dry conditions. Small grain planting continued through April with few weather related interruptions. May was warm and relatively wet at Hettinger with 13 days of measurable precipitation totaling almost 4 inches. June and the first half of July were also wet with rainfall accumulations of almost 6 inches. The last half of July and the month of August were hot and dry. Small grain, canola and flax crops matured about one week ahead of normal and were generally harvested without weather related delays. Small grain yields tended to be well above average with excellent quality. Sunflower, corn and soybeans developed rapidly during this hot period. Corn showed signs of moisture stress during the last week of August.

Small grain disease problems tended to be localized with reports of wheat streak mosaic, leaf rust, severe tan spot, septoria, and head scab. *Ascochyta* blight was common and severe in many chickpea fields causing poor quality and severely reducing yields. Cutworm damage to canola, small grains and early seeded sunflowers were reported. An early and heavy hatch of flea beetles took its toll on seedling canola and alfalfa weevils decimated several alfalfa fields.

All trials at the Hettinger Research Center were planted with a no-till drill. Alternative crops were planted into either field pea or soybean stubble and small grain trials were planted into soybean stubble. Soil fertility was determined and fertilizer was applied according to specific yield goals for each crop. Urea (46-0-0) was the primary nitrogen source used and was applied with a no-till drill prior to planting. Monoammonium phosphate (11-52-0) was applied directly with most seed at planting.

All HRSW, durum and barley trials were treated post emergence for both grass weeds (foxtails and wild oats) and for broadleaf weeds (kochia, Russian thistle and wild buckwheat). All broadleaf crops were treated with a pre-emergence burn down, and with a post emergence treatment for grass weeds and broadleaf weeds when possible.

WEATHER DATA SUMMARY
HETTINGER

Precipitation

Precipitation (inches)	1997-98	1998-99	1999-00	45 year average
Sept. - Dec.	1.58	6.32	2.29	3.29
Jan. - March	2.77	1.25	3.45	1.30
April	0.64	2.30	1.40	1.69
May	1.53	2.32	3.87	2.64
June	3.56	3.84	2.80	3.45
July	1.67	3.30	2.97	2.03
August	1.82	3.36	0.78	1.72
Total	13.57	22.69	17.56	16.12

Air Temperature

Average Temperature F	1997	1998	1999	2000	45 year average
April	34.8	45.6	41.8	42.6	42.5
May	52.0	56.0	53.5	55.0	54.2
June	65.9	57.8	61.2	60.5	63.6
July	68.0	69.7	69.9	71.2	69.8
August	68.0	71.7	68.5	71.8	68.7
September	60.1	65.3	53.3	58.6	57.3

Growing Degree Units - Corn

Growing Degree Units (50-86)	1997	1998	1999	2000	33 year average
May	226	309	230	284	332
June	480	312	381	377	424
July	574	644	574	638	500
August	543	663	565	633	536
September	412	469	259	412	385
Total	2235	2397	2009	2344	2177

Frost Free Days

	28 F	32 F	Normal 32 F
Date of last frost	May 14	May 18	May 18
Date of first frost	Sep 23	Sep 23	Sep 20
Frost free days	132	128	125

Table. 2000 Weather Summary for the Dickinson Research Extension Center, Dickinson, ND.

Month	Max temp		Min temp		Precip		Small Grains GDD1		Corn GDD2	
	Long term 1897-1999	Current year	Long term 1897-1999	Current year	Long term 1897-1999	Current year	Long term 1897-1999	Current Year	Long term 1897-1999	Current Year
	oF	oF	oF	oF	in.	in.				
November-99	39.54	54.63	16.73	22.77	0.50	0.09				
December-99	27.25	39.58	5.52	12.81	0.39	0.29				
January	22.42	29.29	-0.31	3.39	0.51	0.28				
February	26.79	36.66	3.72	10.10	0.40	0.64				
March	37.99	48.71	14.88	21.23	0.72	0.22				
April	55.03	55.77	28.66	27.17	1.45	1.38	377	395		
May	66.92	69.48	39.60	39.71	2.32	1.80	667	711	272	305
June	75.37	73.00	49.23	45.50	3.62	3.09	903	819	406	355
July	82.48	83.87	53.51	56.90	2.17	3.45	1140	1188	569	606
August	81.40	87.74	50.97	54.42	1.76	0.35	1185	1207	530	624
September	71.11	74.17	40.95	40.80	1.37	1.11	740	778	330	371
October	57.92	61.68	30.14	29.61	0.96	0.73				
Mean	53.69	59.55	27.80	30.37						
Total					16.17	13.43	5012	5096	2107	2260

1Small grains GDD, is growing degree days calculated with 95oF maximum temperature and 32oF base temperture.

2 Corn GDD is growing degree days calculated with 86oF maximum temperature and 50oF base temperature.

Source: Dickinson Research Extension Center, Data compiled by Jim Nelson; Animal Scientist, Roger Ashley; Extension Agronomist and Lisa Vance; Information Processing Specialist.

Trial Information 2000 — **Dickinson Research and Extension Center**

Trial	Location	Previous Crop	Seeding Rate
			pls/ac
SMALL GRAINS			
Barley	Dickinson	Millet hay	1,200,000
Durum	Dickinson	Millet hay	1,200,000
Spring wheat	Dickinson	Millet hay	1,200,000
Winter wheat	Dickinson	Fallow	75 lbs*
Winter rye	Dickinson	Fallow	75 lbs*
Oat	Dickinson	Fallow	1,000,000
OTHER CROPS			
Field Pea	Dickinson	Millet hay	325,000

* Rate is seed planted

Trial Fertility Information 2000 — **Dickinson Research and Extension Center**

		Soil test results			Fertilizer applied		
Trial	Location	N	P	K	N	P_2O_5	Form(s)
		lb/ac	ppm	ppm	lb/acre		
SMALL GRAINS							
Barley	Dickinson	26	24	--	111	26	34-0-0, 11-52-0
Durum	Dickinson	26	24	--	111	26	34-0-0, 11-52-0
Spring wheat	Dickinson	26	24	--	111	26	34-0-0, 11-52-0
Winter wheat	Dickinson	--	--	--	85	--	34-0-0
Winter rye	Dickinson	--	--	--	85	--	34-0-0
Oat	Dickinson	90	11	--	50	26	34-0-0, 11-52-0
OTHER CROPS							
Field Pea	Dickinson	20	25	--	--	--	

Table 1. 2001 North Dakota hard red spring wheat variety description table, agronomic traits.

Variety	Agent or Origin[1]	Year Released	Beard	Height	Straw Strength	Maturity	Reaction to Disease[2]				
							Stem Rust	Leaf Rust	Foliar Disease	Root Rot	Head (Scab)
Coteau	ND	1978	yes	med.	m.strg.	med.	R	NA	M	MS	MS
Stoa	ND	1984	yes	med.	m.strg.	m.early	R	MR	MS	M	MS
Butte 86	ND	1986	yes	med.	m.strg.	early	R	MS	MS	MS	MS
Amidon	ND	1988	yes	med.	med.	med.	R	R	M	MR	S
Grandin	ND	1989	yes	s.dwf.	strg.	early	R	S	S	M	S
2370	NDSURF	1990	yes	s,dwf.	v.strg	m.early	R	NA	S	S	MS*
2375	NDSURF	1990	yes	s.dwf.	med.	m.early	R	S	S	M	MS*
Sharp	SD	1990	yes	med.	med.	early	R	MS	MS	S	MS*
AC Barrie	Can	1994	no	med.	med.	med.	R	S	M	M	M
Kulm	ND	1994	yes	med.	strg.	early	R	MR	MS	MS	S
2398	NDSURF	1995	yes	s.dwf.	strg.	m.late	R	S	MR	MS	VS
Ernest	ND	1995	yes	med.	med.	med.	R	MS	MS	MR	S
Glupro	ND	1995	yes	tall	med.	m.late	R	MS	S	NA	VS
Gunner	AgriPro	1995	yes	med.	m.strg.	med.	R	MS	MR	S	M
Hamer	AgriPro	1995	yes	s.dwf.	v.strg.	med.	R	MR	M	NA	S
Lars	AgriPro	1995	yes	s.dwf.	v.strg.	med.	R	R	MR	NA	S
McNeal	MT	1995	yes	med.	strg.	m.early	MS	S	M	M	VS
Russ	SD	1995	yes	med.	med.	m.early	R	R	S	S	S*
Trenton	ND	1995	yes	med.	med.	med.	R	MR	MS	S	S*
Verde	MN	1995	yes	s.dwf.	strg.	med.	R	MR	MR	M	MS*
AC Majestic	Cargil Can	1996	no	med.	med.	med.	R	MS	MR	NA	S*
Keene	ND	1996	yes	med.	med.	med.	R	R	MR	M	S
Oxen	SD	1996	yes	s.dwf.	strg.	m.early	R	R	S	S	S
Sharpshooter	WPB	1996	yes	med.	med	early	R	MR	MS	M	MS
Forge	SD	1997	yes	s.dwf.	m.strg.	early	R	S	MR	MS	MS
Nora	AgriPro	1997	yes	s.dwf.	strg.	med.	R	MS	MS	S	S
Argent[3]	ND	1998	yes	s.dwf.	strg.	early	R	S	S	S	S
Hagar	AgriPro	1998	yes	s.dwf.	strg.	med.	R	MS	M	NA	S
HJ98	MN	1998	yes	s.dwf.	strg.	m.early	R	MS	MS	MS	MS
Ingot	SD	1998	yes	s.dwf.	med.	early	R	S	S	M	MS*
Dandy	N. Star G.	1998	yes	sdwf	v.strg.	early	R	S	MS	S	S
Mckenzie	Terra Int.	1998	yes	med.	med.	m.early	R	R	S	MS	S
Parshall	ND	1999	yes	med.	srtg.	m.early	R[4]	MS	M	M	M
Reeder	ND	1999	yes	s.dwf	strg.	m.early	R	MR	M	M	S
McVey	MN	1999	yes	med.	med.	med.	R	S	S	NA	M
Ivan	AgriPro	1999	yes	s.dwf	v.strg.	med.	R	MR	S	MS	MS
Ember	SDSU	1999	yes	s.dwf	med.	m.early	R	S	S	NA	MS
Aurora	N. Star G.	1999	yes	s.dwf	strg	m.early	R	R	S	NA	S
Mercury	N. Star G.	1999	yes	s.dwf	strg	m.early	R	MR	S	MS	S
Norpro	AgriPro	1999	yes	s.dwf	strg	med	R	R	S	MS	MS
AC Intrepid	Canterra	1999	no	med	med	med	R	R	NA	NA	S
Prodigy	Sask. Wht	1999	yes	med	med	med	MR	MR	NA	NA	MS
Scholar	MT	1999	yes	med	med	med	R	S	NA	NA	S
Conan	WPB	1999	yes	s.dwf	v.strg	med	R	MR	NA	NA	S
AC Abbey	Canterra	1999	yes	med	med	m.early	R	NA	NA	NA	S
GC Impervo	WPB	1999	yes	m.tall	weak	m.late	R	MS	MS	NA	MR
Alsen	ND	2000	yes	s.dwf	strg	m.early	R	R	S	MS	MR

1 Refers to agent or developer: NDSURF = North Dakota State University Research Foundation; CDC = Crop Development Center, University of Saskatchewan; Can = Agriculture Canada.; N. Star G.= North Star Genetics.

2 R = resistant; MR = moderately resistant; M = intermediate; MS = moderately susceptible; S = susceptible; VS = very Susceptible. * Yield and/or quality often higher than expected based on visual head blight symptoms.

3 Argent is a hard white wheat with good bread making qualities.

4 MR in artificially induced epidemics.

Table 2. 2001 North Dakota hard red spring wheat variety descriptions, quality traits.

	Quality factors		
Variety	Test Weight	Wheat Protein	Quality Rating
Coteau	avg.	high	Good
Stoa	high	avg.	Average
Butte 86	high	avg.	Average
Amidon	high	avg.	Average
Grandin	high	avg.	Good
2370	high	avg.	Poor-Average
2375	high	avg.	Poor-Average
Sharp	high	avg.	Poor
AC Barrie	high	avg.	Good
Kulm	high	high	Average-Good
2398	avg.	low	Poor
Ernest	high	high	Poor-Average
Glupro	avg.	v.high	Good
Gunner	high	high	Average-Good
Hamer	avg.	avg.	Poor
Lars	avg.	low	Poor
McNeal	avg.	avg.	Poor-Average
Russ	avg.	avg.	Average
Trenton	high	avg.	Average
Verde	avg.	low	Poor
AC Majestic	N/A	N/A	N/A
Keene	high	avg.	Average
Oxen	avg.	avg.	Average-Good
Sharpshooter†	high	avg.	Poor
Forge†	high	low	Poor-Average
Nora†	avg.	high	Average
Argent	high	avg.	Good
Hagar†	avg.	low	Poor-Average
HJ98†	avg.	low	Poor
Ingot†	high	avg.	Poor-Average
Dandy	N/A	N/A	N/A
Mckenzie	N/A	N/A	N/A
Parshall	high	avg.	Good
Reeder	high	avg.	Average
McVey†	low	low	Poor
Ivan†	high	low	Poor
Ember	N/A	N/A	N/A
Aurora	N/A	N/A	N/A
Mercury	N/A	N/A	N/A
Norpro	N/A	N/A	N/A
AC Intrepid	N/A	N/A	N/A
Prodigy	N/A	N/A	N/A
Scholar	N/A	N/A	N/A
Conan	N/A	N/A	N/A
AC Abbey	N/A	N/A	N/A
GC Impervo	N/A	N/A	N/A
Alsen†	high	avg.	Average-Good

† Based on limited testing, rating may change.

The overall HRSW quality rating is based on a large number of quality parameters . These parameters are related to the physical kernel traits including protein content; milling performance; flour attributes; dough characteristics; and baking performance. Some of these quality parameters considered in the assessment of overall quality are listed in Table 2.

Both protein quantity and quality are of extreme importance in establishing the rating score for hard red spring wheat varieties. Baking quality data given in this report is based on white sliced bread evaluation. Flour used for white sliced bread normally contains between 11.5-12.5% protein. However, the majority of hard red spring wheat used either domestically or in the export market is blended with lower protein wheat or lower quality wheat to improve baking performance. Another major use for hard red spring wheat is for specialty products such as bagels and frozen doughs that require a high protein content with strong gluten properties. In addition, the majority of hard red spring wheat is exported at the 14.0% protein level.

Hard red spring wheat produced in the Upper Midwest is purchased largely for its quality. Continued production of high quality wheat is paramount to maintaining future markets. Figure 1 illustrates the difference between bread made with poor quality wheat and that made with good quality.

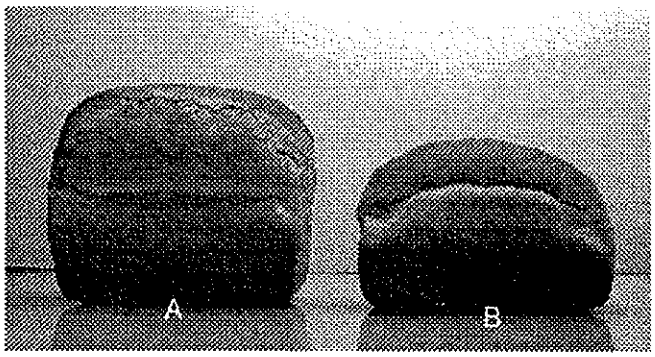


Fig. 1. Loaf A represents bread made from wheat with a quality rating of good. Loaf B represents bread made from wheat with a quality rating of poor.

Table 3. 1999 analytical milling and baking data from field plot variety trials at Carrington, Casselton, Dickinson, Hettinger, Langdon, and Williston. NDSU Department of Cereal Science.

VARIETY	Test Weight	Falling Number	Protein 14% MB	Flour Extraction	Farinogram	Absorbance	Loaf Volume
	lb/bu	seconds	%	%	class	%	cc
AC BARRIE	59.2	478	16.0	70.5	6.2	63.1	1036
ALSEN	60.6	409	15.1	67.0	6.7	66.0	1067
BUTTE 86	59.2	420	15.2	66.9	4.7	66.0	1035
DANDY	59.9	296	14.6	68.3	5.2	63.8	957
EMBER	61.3	377	14.1	70.1	6.2	63.1	941
FORGE	61.0	426	14.2	69.2	6.2	64.4	968
GRANDIN	58.6	421	15.1	67.9	6.2	64.7	1064
GUNNER	61.1	448	15.7	68.2	6.5	66.8	1024
HAGER	58.4	441	14.4	68.7	6.5	65.5	1056
HJ98	58.7	426	14.1	67.9	7.5	64.1	996
IVAN	60.0	418	13.5	69.5	6.3	62.4	923
KEENE	61.2	359	14.7	68.3	6.7	66.9	996
MAJESTIC	58.0	476	15.8	68.8	6.2	65.9	1029
MCVEY	56.4	446	13.3	69.0	5.3	64.2	906
MERCURY	58.9	471	14.4	69.4	6.3	65.3	946
NORA	58.1	420	14.7	66.6	6.7	66.8	989
PARSHALL	61.3	403	14.3	67.7	6.8	66.5	1086
REEDER	60.2	432	14.0	67.5	6.0	65.8	986
RUSS	59.5	391	13.8	67.9	6.3	67.0	1013
TRENTON	59.9	390	14.4	68.5	6.8	65.0	1094

Table 4. Analytical milling and baking data from field plot variety trials, average of 1998-1999. NDSU Department of Cereal Science.

VARIETY	Test Weight	Falling Number	Protein 14% MB	Flour Extraction	Farinogram	Absorbance	Loaf Volume
	lb/bu	seconds	%	%	class	%	cc
AC BARRIE	59.8	468	15.9	70.8	6.1	61.9	1058
BUTTE 86	59.7	427	15.1	68.0	4.9	65.1	1024
FORGE	61.5	442	14.2	69.2	6.4	63.3	986
GRANDIN	59.1	424	15.0	69.2	6.3	63.8	1058
GUNNER	61.4	459	15.7	69.1	6.1	64.9	1040
HJ98	59.5	422	13.9	69.4	7.6	62.0	1027
IVAN	60.4	418	13.4	69.8	6.2	60.6	933
KEENE	61.5	387	14.7	68.8	6.2	65.6	1009
NORA	58.9	433	15.0	67.2	6.7	64.9	1002
PARSHALL	61.6	411	14.6	68.8	6.6	64.4	1075
REEDER	60.7	425	14.3	68.1	6.0	64.0	999
RUSS	59.9	413	14.2	68.6	6.3	65.2	1025

Variety	Days to Head	Plant Height	Test Weight	Protein	Grain Yield			Average Yield	
					1998	1999	2000	2 year	3 year
		inches	lbs/bu	%	bu/ac				
Ivan	75	32	62.4	12.8	82.8	87.3	66.3	76.8	78.8
HJ98	74	36	62.2	13.8	83.4	75.1	68.6	71.8	75.7
Reeder	72	39	61.6	16.8	81.5	82.5	55.8	69.2	73.3
2398	73	35	62.2	13.9	84.7	73.7	58.2	66.0	72.2
Hagar	74	33	61.4	14.7	79.9	75.3	60.2	67.8	71.8
Oxen	71	37	61.3	14.9	68.5	81.5	61.9	71.7	70.6
Forge	68	40	62.3	15.2	81.0	76.5	50.9	63.7	69.5
McVey	75	40	60.8	13.5	73.4	74.5	58.3	66.4	68.7
Ember	71	38	62.3	16.1	78.0	72.3	53.2	62.8	67.8
Russ	72	40	61.9	15.7	76.9	67.8	54.4	61.1	66.4
2375	73	39	63.0	16.0	77.5	64.8	56.9	60.8	66.4
Keene	73	46	62.6	16.5	78.1	68.7	46.3	57.5	64.4
Parshall	73	43	62.6	17.0	73.6	68.5	45.1	56.8	62.4
Gunner	75	39	62.6	16.9	71.7	66.5	46.7	56.6	61.6
Ernest	74	42	62.0	16.3	69.6	65.8	48.8	57.3	61.4
Grandin	74	38	60.7	15.7	71.7	59.2	50.9	55.0	60.6
Butte 86	71	41	61.2	16.0	72.6	63.9	43.9	53.9	60.1
Scholar	75	39	62.2	15.5	75.2	53.2	50.0	51.6	59.5
Ingot	69	42	62.6	16.4	64.1	67.0	45.0	56.0	58.7
Norpro	73	33	61.9	14.9		86.3	66.9	76.6	
Mercury	72	33	61.7	15.5		81.9	67.6	64.8	
Aurora	76	32	60.7	14.2		77.7	63.7	70.7	
McKenzie	73	43	61.9	16.7		74.7	52.2	63.4	
Conan	73	36	61.9	14.9		67.1	56.9	62.0	
Alsen	72	38	62.4	16.4		69.3	52.1	60.7	
Dandy	72	39	61.5	16.0		69.0	51.2	60.1	
377S *	74	37	59.4	13.9		55.9	54.7	55.3	
Zeke	71	35	58.9	14.4			62.6		
AC Vista *	72	38	59.3	13.9			59.3		
McNeal	75	37	60.2	14.2	77.3	--	55.6		
GC Impervo	79	39	62.5	15.6			48.9		
Prodigy	76	44	62.1	17.8			48.4		
Trial Mean	73	39	61.8	15.7	73.9	70.0	53.0	--	--
C.V. %	1.2	4.4	0.9	3.3	8.7	6.2	6.7	--	--
LSD .05	1	2	0.8	0.7	8.9	6.0	4.9	--	--
LSD .01	2	3	1.1	1.0	11.8	7.9	6.5	--	--

* Hard White Spring Wheat Planting Date: April 10, 2000 Harvest Date: August 7, 2000
Seeding rate: 1.1 million live seeds/A (approx. 1.6 bu/A).
Previous crop: 1998 = fallow, 1999 = field pea, 2000 = soybean

Hard Red Spring Wheat - Recrop — **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Returns	Average Yield 2 Year	Average Yield 3 Year
			in	lbs/bu	%	bu/ac	bu/ac	bu/ac	$/ac	bu/ac	bu/ac
Semidwarf											
2375	64	12,539	34	60.4	14.3	68.2	47.1	63.4	159.87	55.3	59.6
2398	66	13,306	31	59.4	12.9	72.9	47.9	61.9	136.16	54.9	60.9
377S*	65	14,647	33	56.3	13.0	--	47.8	59.7	--	53.8	--
AC Vista*	65	11,651	34	57.8	12.1	--	--	67.9	--	--	--
Alsen	63	12,496	31	62.0	15.6	--	49.5	60.9	184.41	55.2	--
Argent*	67	11,727	37	60.4	14.4	63.7	45.6	63.6	--	54.6	57.6
Aurora	69	13,095	28	58.3	12.9	--	51.8	66.3	145.65	59.0	--
Conan	66	11,586	30	60.7	14.0	--	44.6	56.8	141.37	50.7	--
Dandy	67	11,280	34	61.7	13.6	54.6	51.8	64.3	150.47	58.1	56.9
Forge	61	10,965	31	63.1	13.7	67.7	53.9	65.0	155.34	59.4	62.2
Grandin	67	11,836	34	60.0	14.5	64.2	48.9	61.1	155.86	55.0	58.1
Hagar	65	12,605	31	59.1	13.4	73.2	45.9	63.4	148.36	54.7	60.8
HJ 98	66	10,463	31	59.0	13.4	67.6	51.2	64.4	150.61	57.8	61.1
Ivan	64	11,938	26	62.9	13.4	75.2	52.9	59.9	137.18	56.4	62.7
McVey	67	14,314	33	58.0	12.7	72.7	51.6	66.2	142.39	58.9	63.5
Norpro	66	11,834	31	61.3	14.0	--	54.9	69.5	169.59	62.2	--
Oxen	65	12,068	31	60.6	13.9	68.6	53.6	64.0	156.10	58.8	62.1
Reeder	65	13,414	34	60.4	14.5	67.9	48.7	72.0	183.61	60.4	62.9
Verde	68	11,861	32	60.5	14.0	64.8	48.4	72.4	176.72	60.4	61.9
Zeke	63	10,119	33	55.7	12.5	--	--	64.0	130.89	--	--
Trial Mean	65	12,068	34	60.9	14.1	65.0	47.9	65.6	164.46	--	--
C.V. %	3.9	11.6	9.9	1.8	--	9.3	8.0	10.6	--	--	--
LSD .05	4	1,954	5	1.6	--	8.4	5.4	9.7	--	--	--

Planting Date: April 19
Harvest Date: August 11
*Hard White Spring Wheat
Returns were calculated by multiplying the 2000 yield by protein premium or discount paid at the Southwest Grain Terminal located at Gladstone on September 8. The price paid on this date was $2.49/bu, assuming that grain protein concentration was 14%. An additional $.03/bu was paid for each additional 0.2% increase in grain protein up to 15% protein, where an additional $0.35/bu was paid. An additional $0.02/bu was paid for each additional 0.2% increase in grain protein up to 17%, above which an additional premium was not paid. Grain was discounted $0.05/bu for each 0.2% reduction in grain protein from 14% to 13%. Grain was discounted an additional $0.04/bu for each 0.2% reduction in grain protein from 13% to 11%, below which an additional discount was not assigned. Returns factored in discounts for grain with a test weight <58 lb/bu [-$0.01/bu for 0.5 lb/bu between 58 and 57 lb/bu; -$0.02/bu for 0.5 lb/bu between 57 and 55 lb/bu; -$0.03/bu for 0.5 lb/bu between 55 and 50 lb/bu; and -$0.04/bu for 0.5 lb/bu between 50 and 46 lb/bu].

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Returns	Average Yield 2 Year	Average Yield 3 Year
			in	lbs/bu	%	bu/ac	bu/ac	bu/ac	$/ac	bu/ac	bu/ac
Conventional											
AC Cadillac	67	11,940	41	62.9	13.4	61.3	50.6	62.7	146.65	56.6	58.2
Butte 86	65	11,545	36	61.0	14.0	67.3	44.8	71.8	178.81	58.3	61.3
Ember	65	11,282	35	61.4	12.8	71.4	51.5	75.2	165.42	63.3	66.0
Ernest	66	10,639	33	61.2	15.1	69.2	45.3	57.7	172.66	51.5	57.4
GC Impervo	70	13,385	36	60.6	13.5	--	--	59.4	139.03	--	--
Glenlea	69	10,914	39	58.2	14.7	--	--	57.4	147.16	--	--
Gunner	68	13,485	34	61.2	14.7	60.6	47.4	61.8	159.40	54.6	56.6
Ingot	63	12,850	36	64.1	14.3	63.6	54.6	67.3	169.66	61.0	61.8
Keene	67	12,563	37	62.0	14.4	62.2	49.1	70.6	179.97	59.8	60.6
Kulm	63	12,863	35	62.6	14.4	61.9	51.7	67.7	170.67	59.7	60.4
McKenzie	65	11,719	36	60.4	14.9	--	48.3	73.4	191.54	60.8	--
Mercury	65	10,509	27	60.4	13.6	--	47.2	70.2	167.83	58.7	--
Parshall	62	11,679	34	62.4	14.1	65.5	45.1	59.4	147.89	52.2	56.7
Prodigy	69	13,850	40	60.6	14.4	--	43.9	71.5	182.43	57.7	--
Russ	61	10,614	29	62.5	14.9	68.3	53.1	54.6	142.59	53.9	58.7
Scholar	63	12,414	34	60.8	13.9	62.2	44.4	76.2	185.86	60.3	60.9
Trenton	66	11,695	39	61.7	14.6	69.5	46.7	68.6	174.83	57.6	61.6
Trial Mean	65	12,068	34	60.9	14.1	65.0	47.9	65.6	164.46	--	--
C.V. %	3.9	11.6	9.9	1.8	--	9.3	8.0	10.6	--	--	--
LSD .05	4	1,954	5	1.6	--	8.4	5.4	9.7	--	--	--

Planting Date: April 19
Harvest Date: August 11
*Hard White Spring Wheat
Returns were calculated by multiplying the 2000 yield by protein premium or discount paid at the Southwest Grain Terminal located at Gladstone on September 8. The price paid on this date was $2.49/bu, assuming that grain protein concentration was 14%. An additional $.03/bu was paid for each additional 0.2% increase in grain protein up to 15% protein, where an additional $0.35/bu was paid. An additional $0.02/bu was paid for each additional 0.2% increase in grain protein up to 17%, above which an additional premium was not paid. Grain was discounted $0.05/bu for each 0.2% reduction in grain protein from 14% to 13%. Grain was discounted an additional $0.04/bu for each 0.2% reduction in grain protein from 13% to 11%, below which an additional discount was not assigned. Returns factored in discounts for grain with a test weight <58 lb/bu [-$0.01/bu for 0.5 lb/bu between 58 and 57 lb/bu; -$0.02/bu for 0.5 lb/bu between 57 and 55 lb/bu; -$0.03/bu for 0.5 lb/bu between 55 and 50 lb/bu; and -$0.04/bu for 0.5 lb/bu between 50 and 46 lb/bu].

2000 Hard Red Spring Wheat - Continuously Cropped No-till **Scranton**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
	inches	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Oxen	35	63.4	12.4	35.1	41.1	65.5	53.3	47.2
Keene	44	62.9	13.4	32.1	33.4	61.8	47.6	42.4
2398	33	62.7	11.6	35.0	35.6	54.5	45.0	41.7
2375	38	63.4	13.1	27.6	31.0	61.8	46.4	40.1
Grandin	37	62.2	12.9	27.5	27.6	54.8	41.2	36.6
Reeder	37	62.7	14.4		40.1	67.0	53.6	
Parshall	43	63.5	14.0		34.6	64.3	49.4	
Norpro	34	63.9	12.2			67.4		
Alsen	35	62.9	14.0			63.7		
Ivan	31	63.3	11.0			63.3		
Ember	37	64.2	11.6			61.5		
Ingot	44	64.8	13.0			52.9		
Trial Mean	37	63.3	12.8	31.0	33.8	61.5	--	--
C.V. %	3.3	0.9	--	9.8	10.1	8.1	--	--
LSD .05	3	1.0	--	4.4	5.8	8.4	--	--
LSD .01	4	1.3	--	5.9	7.9	11.4	--	--

Planting Date: April 11, 2000
Harvest Date: August 9, 2000
Seeding rate: 1.1 million live seeds/A (approx. 1.6 bu/A).
Previous Crop: 1998 & 1999 = HRSW
2000 = HRWW

2000 Hard Red Spring Wheat - Continuously Cropped No-till **Regent**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
	inches	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
2375	25	61.7	12.5	37.3	59.0	30.7	44.8	42.3
2398	30	63.1	13.0	39.5	55.6	31.6	43.6	42.2
Oxen	27	61.5	13.7	37.2	56.0	32.3	44.2	41.8
Keene	32	61.3	13.7	38.5	50.5	29.8	40.2	39.6
Grandin	29	60.1	14.5	29.8	40.6	29.3	35.0	33.2
Reeder	28	60.6	15.4		51.0	39.1	45.0	
Parshall	31	62.6	14.3		47.2	29.9	38.6	
Ivan	26	62.4	12.4			37.9		
Norpro	26	62.0	13.5			36.2		
Alsen	28	62.3	13.8			31.7		
Ember	28	62.7	12.5			30.4		
Ingot	30	63.5	13.0			29.7		
Trial Mean	28	62.0	13.5	35.9	50.5	32.2	--	--
C.V. %	5.3	1.1	--	7.9	8.7	11.2	--	--
LSD .05	3	1.1	--	4.1	7.4	6.1	--	--
LSD .01	5	1.5	--	5.5	10.0	8.2	--	--

Planting Date: April 12, 2000
Harvest Date: August 3, 2000
Seeding rate: 1.1 million live seeds/A (approx. 1.6 bu/A).
Previous Crop: 1998 = HRSW
1999 = HRSW
2000 = HRWW

2000 Hard Red Spring Wheat - Continuously Cropped No-till **New Leipzig**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
	inches	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Oxen	29	61.1	13.8	36.4	54.5	44.7	49.6	45.2
2375	30	61.1	12.8	31.4	45.7	42.4	44.0	39.8
2398	29	60.4	--	31.9	41.4	40.2	40.8	37.8
Keene	33	60.5	14.2	26.2	44.9	41.3	43.1	37.5
Grandin	31	56.8	14.2	27.8	31.0	37.5	34.2	32.1
Reeder	30	61.1	15.7		53.1	45.9	49.5	
Parshall	34	60.9	14.5		42.3	43.0	42.6	
Alsen	30	60.6	15.3			43.9		
Ivan	25	60.1	11.9			42.5		
Norpro	26	59.5	13.8			42.4		
Ingot	35	63.3	14.2			41.6		
Ember	30	61.0	12.9			39.9		
Trial Mean	30	60.5	13.9	29.7	43.7	42.1	--	--
C.V. %	5.4	1.1	--	9.9	8.1	8.1	--	--
LSD .05	3	1.1	--	4.4	5.1	NS	--	--
LSD .01	5	1.6	--	6.0	6.8	NS	--	--

Planting Date: April 12, 2000
Harvest Date: August 3, 2000
Seeding rate: 1.1 million live seeds/A (approx. 1.6 bu/A).
Previous Crop: 1998 = HRSW
1999 = HRSW
2000 = HRWW
Notes: Minor hail damage. Moderate to severe foliar (leaf rust, tan spot and septoria) disease and approx. 10% scabby heads.

2000 Hard Red Spring Wheat - Continuously Cropped No-till **Selfridge**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
	inches	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Oxen	39	60.8	13.4	52.7	49.0	51.1	50.0	50.9
2375	40	62.6	14.0	55.4	42.6	50.1	46.4	49.4
Keene	45	62.2	14.3	50.5	46.4	47.3	46.8	48.1
2398	35	61.4	13.6	58.9	38.0	47.0	42.5	48.0
Grandin	38	60.0	15.3	45.3	26.6	45.2	35.9	39.0
Reeder	40	61.8	14.6		44.9	52.3	48.6	
Parshall	45	61.8	16.6		44.4	46.4	45.4	
Ivan	34	62.0	12.8			53.6		
Norpro	35	60.8	12.8			53.6		
Alsen	38	63.1	14.8			48.9		
Ingot	42	64.0	14.2			48.9		
Ember	38	62.0	12.9			47.7		
Trial Mean	39	61.9	14.1	50.3	40.5	49.3	--	--
C.V. %	3.9	0.9	--	7.0	8.1	4.3	--	--
LSD .05	3	0.8	--	6.0	4.7	3.6	--	--
LSD .01	5	1.1	--	8.1	6.3	4.9	--	--

Planting Date: April 13, 2000
Harvest Date: August 10, 2000
Seeding rate: 1.1 million live seeds/A (approx. 1.6 bu/A).
Previous Crop: 1998 = HRSW
1999 = Sunflower
2000 = HRWW

2000 Hard Red Spring Wheat - Continuously Cropped No-till **Mandan**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
	inches	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
2375	40	62.4	14.5	55.2	39.2	53.6	46.4	49.3
Oxen	39	58.6	14.2	52.6	36.0	59.1	47.6	49.2
2398	37	58.6	12.9	58.8	38.5	47.7	43.1	48.3
Keene	47	59.8	16.1	50.4	39.8	48.6	44.2	46.3
Grandin	39	58.6	15.5	45.2	23.4	41.7	32.6	36.8
Reeder	41	60.5	16.3		46.9	60.3	53.6	
Parshall	45	61.9	16.9		42.9	54.1	48.5	
Ivan	36	59.9	12.1			59.7		
Norpro	38	58.9	13.5			57.4		
Ember	40	61.7	14.8			50.9		
Alsen	39	61.4	16.2			50.2		
Ingot	40	62.6	13.0			48.9		
Trial Mean	40	60.4	14.7	50.2	39.3	52.7	--	--
C.V. %	3.4	1.1	--	7.0	12.5	9.5	--	--
LSD .05	3	1.0	--	6.0	8.3	7.2	--	--
LSD .01	4	1.3	--	8.0	11.3	9.6	--	--

Planting Date: April 13, 2000
Harvest Date: August 10, 2000
Seeding rate: 1.1 million live seeds/A (approx. 1.6 bu/A).
Previous Crop: 1998 = HRSW
1999 = Rye
2000 = Barley

Performance of five hard red spring (HRS) wheat cultivars following fallow, oat, and canola at Beulah, Hannover, and Glen Ullin, North Dakota.

	Beulah					Hannover					Glen Ullin				
	height	yield	TW	protein	kernel weight	height	yield	TW	protein	kernel weight	height	yield	TW	protein	kernel weight
Crop rotation (R)	-in-	-bu/ac-	-lb/bu-	-%-	kernel/lb	-in-	-bu/ac-	-lb/bu-	-%-	kernel/lb	-in-	-bu/ac-	-lb/bu-	-%-	kernel/lb
HRS wht-fallow	31	47.4	58.9	14.0	15,387	34	50.5	56.0	14.1	15,323	34	70.0	59.4	14.0	14,878
HRS wht-durum-oat	31	45.4	59.1	14.2	14,623	36	48.3	57.9	13.7	14,444	35	64.6	59.8	12.6	14,426
HRS wht-pea-can	31	49.8	59.2	13.6	14,697	33	47.8	57.0	14.0	15,157	32	56.1	60.5	13.3	14,195
HRS wheat cultivar (C)															
Ember	28	51.1	60.2	13.6	14,955	33	46.8	55.7	12.9	15,259	31	64.2	61.0	12.1	14,972
Ingot	33	46.6	61.0	14.0	14,901	38	48.4	59.4	13.4	15,151	36	59.2	62.7	12.7	14,511
Oxen	28	47.6	57.6	13.6	14,779	31	51.8	55.1	13.9	15,425	32	67.1	56.8	13.3	14,924
Parshall	34	43.8	58.3	13.9	14,821	37	47.5	58.4	14.9	14,339	37	64.1	60.6	14.4	13,924
Reeder	31	48.4	58	14.5	15,056	33	49.8	56.2	14.6	14,700	34	63.3	58.3	14.1	14,167
Mean	31	47.5	59	13.9	14,902	34	48.9	57.0	13.9	14,975	34	63.6	59.9	13.3	14,500
R	NS	*	NS	NS	*	*	NS	*	*	*	*	*	*	*	NS
C	*	*	*	NS	NS	*	*	*	*	*	*	*	*	*	*
R x C	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	*	NS	NS	NS	NS

Additional information about this or other crop rotation studies coordinated by the NDSU Dickinson Research Extension Center can be obtained by contacting Dr. Patrick Carr at 701-483-2581 or by email pcarr@ndsu.nodak.edu.

NS = not significant; * = significant at P<0.05.

Planting Date: May 5
Harvest Date: August 21 (Hannover) August 16 (Glen Ullin) August 14 (Beulah)

Hard Red Spring Wheat - Fallow — **Wibaux, MT**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1998	1999	2000	Returns[1] +/- McNeal	Average Yield 2 Year	3 Year
	in	lbs/bu	%	----------bu/ac----------			$/ac	-----bu/ac----	
Scholar	28	62.3	16.6	51.0	34.8	46.9	8.82	40.9	44.2
Amidon	30	62.0	17.0	51.4	38.6	46.7	7.78	42.7	45.6
McNeal	26	62.0	15.8	56.4	29.5	45.2	0.00	37.4	43.7
Reeder	26	63.3	18.1	59.8	37.6	45.1	-0.52	41.4	47.5
Bounty	24	62.2	15.6	--	--	44.8	-2.08	--	--
McVey	26	61.8	14.5	--	--	43.7	-12.16	--	--
Parshall	28	63.5	18.6	55.3	40.3	42.4	-14.53	41.4	46.0
Alsen	27	63.7	18.9	--	--	42.0	-16.61	--	--
Verde	26	62.7	16.9	58.3	--	41.9	-17.13	--	--
Ernest	30	63.0	17.3	49.5	35.2	40.1	-19.20	37.7	41.6
Mercury	20	63.0	17.5	--	--	36.3	-46.19	--	--
Conan	24	63.0	16.2	--	30.8	33.6	-60.20	32.2	--
Dandy	24	63.0	16.9	--	--	33.4	-61.24	--	--
ID377S*	24	62.2	15.6	--	35.0	47.6	0.0	41.3	--
Argent*	29	63.3	18.8	54.1	33.7	41.2	0.0	37.5	43.0
Trial Mean	25	62.9	16.5	--	--	41.8	--	--	--
C.V. %	5.6	0.4	1.8	--	--	7.7	--	--	--
LSD .05	2	0.4	0.5	--	--	5.3	--	--	--

Planting Date: April 27
Harvest Date: August 17

[1] Wheat prices summarized by Gregg Carlson, NAC, Havre, MT, from 6-year average of daily market values for PNW, supplied by the Montana Wheat and Barley Committee.

* No average price for hard white wheat available at this time.

Hard Red Spring Wheat in Southwestern North Dakota
Combined Means

Variety	Days to Head	Plant Height	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
		inches	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Oxen	68	33	59.7	13.8	50.2	48.2	48.5	48.4	49.0
2398	70	33	61.1	13.0	54.5	41.9	48.7	45.3	48.4
2375	68	35	62.1	13.9	50.4	42.4	51.3	46.8	48.0
Keene	70	41	61.6	14.7	48.3	43.8	49.4	46.6	47.2
Grandin	70	35	59.8	14.7	44.5	34.2	45.8	40.0	41.5
Reeder	68	34	60.4	15.4		50.6	54.0	52.3	
Parshall	68	37	61.5	15.4		45.7	49.1	47.4	
Norpro	70	33	61.2	13.5			56.2		
Ivan	70	30	61.9	12.3			54.7		
Ember	68	34	61.2	13.2			53.0		
Alsen	68	33	62.3	15.6			49.2		
Ingot	66	38	62.8	13.8			48.8		
# of locations	2	11	11	11	7	10	11	21	28

Locations: Hettinger, Dickinson, Scranton, Regent, Selfridge, New Leipzig, Mandan, Hannover, Beulah, Glen Ullin & Wibaux, MT.

Foliar Diseases - HRSW **Hettinger**

Observations by **Amy Dukart**, NDSU Extension Summer Intern

	Leaf Rust		Tan Spot		Septoria	
Variety	1999	2000	1999	2000	1999	2000
	% Flag Leaf Infection					
2375	30	10	10	10	10	10
Butte 86	5	3	10	3	25	5
Grandin	50	5	1	10	25	10
2398	30	10	15	5	10	5
Russ	5	3	5	5	35	5
Oxen	10	3	10	5	10	5
Gunner	15	1	15	10	3	3
Keene	0	0	15	10	0	5
Forge	20	3	20	10	20	10
Hager	25	5	5	10	5	5
HJ98	45	3	20	3	10	5
Ingot	20	10	25	10	10	10
Norpro	0	0	5	5	10	3
Ivan	3	0	15	5	2	5
McVey	25	10	0	10	5	10
Ember	10	3	5	10	15	5
Parshall	40	3	20	5	30	10
Reeder	30	3	30	5	5	10
Conan	35	3	30	5	30	5
377S	5	10	10	5	15	15
Dandy	50	3	15	3	15	5
McKenzie	3	1	15	10	10	10
Aurora	3	5	5	5	5	5
Ernest	5	3	20	5	5	5
Scholar	5	30	20	5	0	5
Alsen	0	0	15	3	10	5
AC Vista		10		20		5

Continued on next page.

Foliar Diseases - HRSW continued						Hettinger
	Leaf Rust		Tan Spot		Septoria	
Variety	1999	2000	1999	2000	1999	2000
	---------- % Flag Leaf Infection ----------					
Mercury		3		5		5
Prodigy		1		5		3
Zeke		5		3		3
GC Impervo		5		10		10
McNeal		10		10		5
Trenton	35		5		5	
AC Abbey	25		5		5	
AC Intrepid	15		5		5	
Sharp	15		5		25	
2371	30		15		15	
Kulm	15		10		15	
Hamer	1		10		5	
Nora	20		25		0	
Argent	40		5		10	
Majestic	15		5		20	
Sharpshooter	20		5		15	
AC Cadillac	40		5		10	
Lars	1		25		10	
AC Barrie	25		10		40	
Verde	5		15		15	
Amidon	0		3		20	

Planting Date: April 14, 1999, April 10, 2000
Date of Observation: July 22, 1999, July 10, 2000
Previous crop: 1999 = Field peas, 2000 = Soybeans.

Table 1. 2001 North Dakota durum wheat variety descriptions, agronomic traits.

Variety	Agent or Origin[1]	Year Released	Chaff Color	Height	Straw Strength	Maturity	Reaction to Disease[2]			
							Stem Rust	Leaf Rust	Foliar Disease	Scab
Ward	ND	1972	tan	tall	v.strg.	m.early	R	R	MR	S
Rugby	ND	1973	tan	tall	v.strg.	m.early	R	R	MR	S*
Cando	ND	1975	tan	s.dwf.	v.strg.	med.	R	R	M	VS
Vic	ND	1979	white	tall	med.	m.early	R	R	MR	S*
Lloyd	ND	1983	white	s.dwf.	v.strg.	med.	R	MR	S	VS
Medora	Can.	1983	white	tall	strg.	m.early	R	R	MS	VS
Kyle	Can.	1984	white	tall	weak	med.	R	MR	M	N/A
Laker	WPB	1985	white	s.dwf.	strg.	med.	R	MR	S	S
Monroe	ND	1985	white	tall	med.	early	R	R	M	VS
Fjord	AgriPro	1986	white	tall	strg.	m.early	R	R	M	S
Renville	ND	1988	white	tall	med.	med.	R	R	M	S*
Plenty	Can.	1990	white	tall	weak	late	R	R	MR	MS
Voss	AgriPro	1994	white	s.dwf.	v.strg.	med.	R	MR	MS	S
Munich	ND	1995	white	med.	v.strg.	med.	R	R	MR	S*
AC Melita	Can.	1995	white	tall	med.	med.	R	N/A	N/A	S
Ben	ND	1996	white	med.	strong	med.	R	R	MR	S*
Dressler	AgriPro	1996	white	tall	med.	med.	R	MR	N/A	VS
AC Morse	Can.	1996	white	s.dwf.	strong	med.	R	R	M	N/A
AC Avonlea	Can.	1997	white	med	med.	med.	R	R	M	N/A
Belzer	ND	1997	white	tall	med.	late	R	R	M	MR
Maier	ND	1998	white	med	strong	m-late	R	R	M	S*
Mountrail	ND	1998	white	med	strong	late	R	R	M	S*
Kari	Agripro	1998	white	med	strong	med	R	R	M	S
Lebsock	ND	1999	white	med	strong	med	R	R	M	S
Plaza	ND	1999	white	s.dwf.	strong	late	R	R	M	MS
AC Pathfinder	Can.	1999	white	med.	weak	med.	R	R	M	N/A
AC Navigator	Can.	1999	white	s.dwf.	weak	med.	R	R	M	N/A

1 Refers to agent or developer: WPB = Western Plant Breeder.

2 R = resistant; MR = moderately resistant (slow rusters); M = intermediate; MS = moderately susceptible; S = susceptible; VS = very susceptible; Foliar Disease = reaction to tan spot and septoria leaf spot complex. Letter ratings for head blight (scab) based on visual head symptoms. * Indicates yields and/or quality have often been higher than would be expected based on visual symptoms.

2000 Durum - Continuously Cropped No-till **Hettinger**

Variety	Days to Head	Plant Height	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
		inches	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Maier	76	40	63.8	14.7	76.3	84.0	63.9	74.0	74.7
Munich	74	37	62.8	14.2	69.5	86.8	59.6	73.2	72.0
Lebsock	74	39	63.8	14.8	75.8	81.8	57.1	69.4	71.6
Plaza	77	33	62.6	14.0	69.8	79.9	65.4	72.6	71.7
Mountrail	77	39	62.6	14.4	65.1	91.4	55.9	73.6	70.8
Kari	74	39	62.9	14.4	68.2	84.3	60.0	72.2	70.8
Belzer	76	42	62.0	14.3	69.5	78.4	60.2	69.3	69.4
Ben	76	42	63.4	14.8	69.6	83.7	54.0	68.8	69.1
Renville	75	44	63.0	14.5	69.1	78.3	58.4	68.4	68.6
Dressler	74	43	63.2	15.1	71.3	78.0	55.8	66.9	68.4
Monroe	72	43	62.7	14.5	66.9	76.0	53.8	64.9	65.6
Rugby	74	43	62.9	14.9	68.4	76.5	50.7	63.6	65.2
AC Melita	75	43	62.2	15.4	67.6	72.1	55.0	63.6	64.9
Plenty	76	44	62.7	14.9	69.7	66.5	52.7	59.6	63.0
1AS/1D2	76	46	61.5	15.4		61.7	39.8	50.8	
AC Avonlea	74	40	62.1	15.5			55.6		
Trial Mean	75	40	63.0	14.6	69.4	80.4	58.4	--	--
C.V. %	1.4	3.8	0.7	4.1	9.1	4.3	7.6	--	--
LSD .05	1	1	0.6	0.8	NS	4.9	6.2	--	--
LSD .01	2	2	0.8	1.1	NS	6.4	8.2	--	--

Planting Date: April 10, 2000 Harvest Date: August 7, 2000
Seeding rate: 1.25 million live seeds/A (approx. 2.2 bu/A).
Previous crop: 1998 = fallow, 1999 = field pea, 2000 = soybean
NS = no statistical differences between varieties.

Durum - Recrop — **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Returns	Average Yield 2 Year	Average Yield 3 Year
			in	lbs/bu	%	bu/ac	bu/ac	bu/ac	$/ac	bu/ac	bu/ac
AC Avonlea	62	9,896	29	61.3	14.5	53.0	52.5	45.8	130.46	49.1	50.4
AC Melita	61	10,273	27	62.2	16.0	49.0	51.0	40.4	115.25	45.7	46.8
AC Morse	61	10,453	26	61.8	14.9	53.5	56.4	42.3	120.45	49.3	50.7
AC Navigator	63	9,967	25	61.6	14.2	--	56.0	46.3	131.93	51.1	--
AC Pathfinder	62	10,649	27	62.0	14.5	--	56.6	40.1	114.23	48.3	--
Belzer	62	10,251	28	60.1	14.7	55.9	52.9	39.3	111.86	46.1	49.4
Ben	62	10,290	31	61.6	14.7	54.5	51.7	40.7	116.07	46.2	49.0
Dressler	62	9,884	28	62.0	15.1	47.8	47.7	44.5	126.78	46.1	46.7
IDL092	63	10,517	27	60.2	14.2	--	52.7	36.5	104.16	44.6	--
Kari	62	11,709	26	62.0	15.0	52.6	53.1	40.0	114.00	46.6	48.6
Lebsock	62	10,939	27	62.2	14.8	51.6	50.6	38.9	110.77	44.7	47.0
Maier	62	9,519	27	61.9	15.1	51.9	54.3	47.1	134.11	50.7	51.1
Medora	61	11,533	28	62.1	14.6	52.4	55.2	46.3	132.06	50.8	51.3
Monroe	59	10,150	29	60.7	14.8	50.5	49.0	39.5	112.53	44.2	46.3
Mountrail	62	11,416	25	62.3	15.1	53.8	55.4	50.4	143.67	52.9	53.2
Munich	60	10,879	25	61.8	15.5	54.0	54.6	42.2	120.39	48.4	50.3
Plaza	62	10,773	24	61.8	14.0	54.7	55.4	44.6	127.05	50.0	51.6
Plenty	63	10,016	31	61.7	13.4	49.6	53.7	44.8	127.81	49.3	49.4
Renville	62	11,280	30	61.3	15.0	51.0	52.4	44.8	127.67	48.6	49.4
Rugby	62	10,812	31	61.6	15.6	47.6	47.2	39.9	113.65	43.5	44.9
Vic	61	10,171	30	61.8	13.8	60.1	54.0	48.6	138.48	51.3	54.2
Trial Mean	62	10,487	27	61.7	14.8	52.8	54.6	43.4	123.55	--	--
C.V. %	1.0	8.6	7.9	1.1	--	11.2	6.3	11.8	11.8	--	--
LSD .05	0.9	1,257	3	0.9	--	8.3	4.8	7.1	20.32	--	--

Planting Date: April 19
Harvest Date: August 11
Returns were calculated by multiplying the 2000 yield by the test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8. The price paid on this date was $2.85/bu, assuming a minimum test weight of 60 lb/bu. Grain was discounted $.01/bu for each 0.5 lb reduction in test weight between 60 and 59 lb/bu, $.03/bu per 0.5 lb reduction between 59 and 58 lb/bu, $0.04/bu between 58 and 55 lb/bu, and $0.05/bu per 0.5 lb/bu reduction between 55 and 50 lb/bu.

2000 Durum - Continuously Cropped No-till — **Scranton**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
	inches	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Mountrail	37	62.7	12.6	23.1	40.3	71.1	55.7	44.8
Ben	39	62.0	13.0	23.7	42.0	64.1	53.0	43.3
Maier	37	62.6	12.8	19.2	35.7	68.5	52.1	41.1
Plaza	29	61.7	11.8		37.0	62.8	49.9	
Lebsock	35	62.3	13.4		36.0	60.0	48.0	
Trial Mean	36	62.3	12.7	22.0	37.7	65.9	--	--
C.V. %	3.4	1.7	--	8.0	11.0	7.2	--	--
LSD .05	3	NS	--	2.6	NS	NS	--	--
LSD .01	5	NS	--	NS	NS	NS	--	--

Planting Date: April 11, 2000 Harvest Date: August 9, 2000
Seeding rate: 1.25 million live seeds/A (approx. 2.2 bu/A).
Previous Crop: 1998 & 99 = HRSW, 2000 = HRWW
NS = no statistical difference between varieties.

2000 Durum - Continuously Cropped No-till — **Regent**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
	inches	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Ben	30	60.8	14.0	38.6	43.7	41.3	42.5	41.2
Mountrail	28	59.3	14.9	33.5	44.5	44.5	44.5	40.8
Maier	28	60.5	13.3	30.8	46.9	41.3	44.1	39.7
Lebsock	28	62.4	12.6		45.6	44.2	44.9	
Plaza	24	60.2	13.7		41.3	41.3	41.3	
Trial Mean	28	60.8	13.8	33.0	43.2	42.3	--	--
C.V. %	3.0	0.7	--	7.7	7.6	4.0	--	--
LSD .05	2	0.8	--	3.8	NS	NS	--	--
LSD .01	3	1.2	--	5.2	NS	NS	--	--

Planting Date: April 12, 2000 Harvest Date: August 3, 2000
Seeding rate: 1.25 million live seeds/A (approx. 2.2 bu/A).
Previous Crop: 1998 & 99 = HRSW, 2000 = HRWW
NS = no statistical difference between varieties.

2000 Durum - Continuously Cropped No-till — **New Leipzig**

Variety	Plant Height	Test Weight	Protein	-- Grain Yield -- 1999	2000	2 year Avg.
	inches	lbs/bu	%	bu/ac		
Mountrail	26	61.2	14.0	44.2	38.5	41.4
Plaza	23	62.5	12.8	41.8	39.3	40.6
Maier	24	61.9	14.5	43.0	34.9	39.0
Lebsock	25	62.7	13.4	42.2	35.1	38.6
Ben	26	61.9	13.8	41.7	32.7	37.2
Trial Mean	25	62.1	13.4	42.2	35.9	--
C.V. %	7.2	0.4	--	9.9	6.1	--
LSD .05	NS	0.4	--	NS	3.3	--
LSD .01	NS	0.5	--	NS	4.5	--

Planting Date: April 12, 2000 Harvest Date: August 3, 2000
Seeding rate: 1.25 million live seeds/A (approx. 2.2 bu/A).
Previous Crop: 1998 & 99 = HRSW, 2000 = HRWW
NS = no statistical difference between varieties.
Notes: Moderate hail damage. Approx. 10% Scabby heads.

2000 Durum - Continuously Cropped No-till — **Selfridge**

Variety	Plant Height	Test Weight	Protein	-------- Grain Yield -------- 1998	1999	2000	Average Yield 2 year	3 year
	inches	lbs/bu	%	bu/ac				
Ben	41	63.0	12.8	64.6	51.5	60.2	55.8	58.8
Mountrail	39	62.2	12.7	60.9	48.3	61.1	54.7	56.8
Maier	39	63.1	13.3	59.7	44.5	65.2	54.8	56.5
Lebsock	40	62.5	13.4		43.5	62.5	53.0	
Plaza	32	61.2	12.7		43.4	59.9	51.6	
Trial Mean	39	62.6	12.9	60.5	45.0	62.0	--	--
C.V. %	3.7	1.5	--	17.9	8.3	6.4	--	--
LSD .05	4	1.4	--	NS	NS	NS	--	--

Planting Date: April 12, 2000 Harvest Date: August 3, 2000
Seeding rate: 1.25 million live seeds/A (approx. 2.2 bu/A).
Previous Crop: 1998 = HRSW, 1999 = Sunflower, 2000 = HRWW
NS = no statistical difference between varieties.

2000 Durum - Continuously Cropped No-till — **Mandan**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
	inches	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Mountrail	42	59.1	14.7	57.0	60.5	66.1	63.3	61.2
Ben	43	59.4	14.9	53.6	59.0	62.0	60.5	58.2
Maier	41	58.9	15.4	54.6	51.9	63.5	57.7	56.7
Lebsock	41	60.6	14.4		55.0	66.4	60.7	
Plaza	31	54.9	14.7		45.3	42.2	43.8	
Trial Mean	40	58.9	14.7	52.3	54.4	61.3	--	--
C.V. %	1.9	1.9	--	5.2	8.9	14.4	--	--
LSD .05	2	1.6	--	NS	8.6	13.2	--	--
LSD .01	3	2.3	--	NS	NS	18.1	--	--

Planting Date: April 13, 2000 Harvest Date: August 10, 2000
Seeding rate: 1.25 million live seeds/A (approx. 2.2 bu/A).
Previous Crop: 1998 = HRSW, 1999 = Rye, 2000 = Barley
NS = no statistical difference between varieties.

Hannover Durum - Recrop — **Dickinson, ND**

Variety	Seeds per Pound	Plant Height	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Returns	Average Yield 2 Year	Average Yield 3 Year
		in	lbs/bu	%	bu/ac	bu/ac	bu/ac	$/ac	bu/ac	bu/ac
Belzer	12,304	38	55.8	15.1	--	--	47.7	93.37	--	--
Lebsock	13,424	37	59.1	14.8	43.3	15.2	39.4	84.12	27.3	32.6
Maier	12,695	37	58.9	15.5	--	12.7	52.8	113.20	32.7	--
Mountrail	13,214	38	56.8	14.8	--	15.1	49.0	97.94	32.1	--
Plaza	13,400	32	55.3	14.7	42.8	10.4	40.5	79.89	25.5	31.2
Trial Mean	13,007	36	57.2	15.0	41.5	20.3	45.9	93.71	--	--
C.V. %	6.8	5.1	3.1	--	3.5	14.8	8.2	12.7	--	--
LSD .05	NS	4	NS	--	2.2	NS	7.1	NS	--	--

Planting Date: May 3 Harvest Date: August 21
Returns were calculated by multiplying the 2000 yield by the test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8. The price paid on this date was $2.85/bu, assuming a minimum test weight of 60 lb/bu. Grain was discounted $.01/bu for each 0.5 lb reduction in test weight between 60 and 59 lb/bu, $.03/bu per 0.5 lb reduction between 59 and 58 lb/bu, $0.04/bu between 58 and 55 lb/bu, and $0.05/bu per 0.5 lb/bu reduction between 55 and 50 lb/bu.

Beulah Durum - Recrop — **Dickinson, ND**

Variety	Seeds per Pound	Plant Height	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Returns	Average Yield 2 Year	Average Yield 3 Year
		in	lbs/bu	%	-------bu/ac-------			$/ac	----bu/ac----	
Belzer	12,194	34	57.4	14.8	--	--	37.3	102.72	--	--
Lebsock	12,529	32	59.7	15.0	24.1	19.7	42.4	120.23	31.0	28.7
Maier	11,713	31	60.1	14.5	--	17.1	37.7	107.18	27.4	--
Mountrail	12,256	30	58.4	13.9	--	20.5	43.3	122.05	31.9	31.9
Plaza	12,661	29	57.8	14.1	23.5	23.1	45.3	124.63	34.2	30.6
Trial Mean	12,271	31	58.7	14.4	25.2	20.3	41.2	115.36	--	--
C.V. %	6.0	4.3	2.9	--	7.9	14.8	11.6	13.1	--	--
LSD .05	NS	3	NS	--	NS	NS	NS	NS	--	--

Planting Date: May 3 Harvest Date: August 14

Glen Ullin Durum - Recrop — **Dickinson, ND**

Variety	Seeds per Pound	Plant Height	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Returns	Average Yield 2 Year	Average Yield 3 Year
		in	lbs/bu	%	-------bu/ac-------			$/ac	----bu/ac----	
Belzer	12,405	37	58.7	13.7	--	--	64.3	173.02	--	--
Lebsock	12,975	35	59.3	13.6	53.2	35.9	65.9	177.82	50.9	51.7
Maier	13,042	35	59.6	14.0	--	33.6	61.6	171.83	47.6	--
Mountrail	13,205	37	58.1	13.2	--	42.5	72.2	192.79	57.3	--
Plaza	12,795	31	57.6	12.8	47.9	38.0	65.3	170.73	51.7	50.4
Trial Mean	12,885	35	58.7	13.5	49.9	38.0	65.9	177.24	--	--
C.V. %	4.8	2.9	1.0	--	5.0	8.7	9.5	10.1	--	--
LSD .05	NS	2	1.2	--	3.7	NS	NS	NS	--	--

Planting Date: May 3 Harvest Date: August 16

Returns were calculated by multiplying the 2000 yield by the test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8. The price paid on this date was $2.85/bu, assuming a minimum test weight of 60 lb/bu. Grain was discounted $.01/bu for each 0.5 lb reduction in test weight between 60 and 59 lb/bu, $.03/bu per 0.5 lb reduction between 59 and 58 lb/bu, $0.04/bu between 58 and 55 lb/bu, and $0.05/bu per 0.5 lb/bu reduction between 55 and 50 lb/bu.

Durum - Fallow	Wibaux, MT

Variety	Plant Height	Test Weight	Protein	Grain yield 1999	Grain yield 2000	Returns	2 Year Average
	in	lbs/bu	%			$/ac	bu/ac
Mountrail	29	62.0	16.1	37.1	48.4	137.94	42.8
Plaza	26	62.2	15.7	40.0	46.4	132.24	43.2
Kyle	33	61.8	16.6	38.7	44.9	127.97	41.8
AC Avonlea	27	62.0	17.2	--	43.6	124.26	--
Ben	32	62.8	16.9	32.3	43.5	123.98	37.9
Belzer	29	60.8	16.3	--	43.4	123.69	--
Munich	26	62.2	17.1	36.5	42.8	121.98	36.7
Lebsock	28	62.3	16.8	43.5	42.4	120.84	43.0
Renville	32	62.3	16.5	32.1	41.5	118.28	36.8
AC Melita	32	62.0	16.5	--	39.9	113.72	--
Maier	28	62.5	17.4	38.4	39.3	112.01	38.9
AC Morse	27	61.5	16.8	--	38.4	109.44	--
Trial Mean	28	62	16.6	--	42.4	--	--
C.V. %	6.1	0.6	1.8	--	7.7	--	--
LSD .05	3	0.7	0.5	--	5.5	--	--

Planting Date: April 27
Harvest Date: August 17

Returns were calculated by multiplying the 2000 yields by the price paid for hard amber durum paid at the Southwest Grain Terminal locate at Gladstone on September 8. The price paid on this date was $2.85/bu assuming the test weight was heavier than 60 lb/bu.

Durum in Southwestern North Dakota
Combined Means

Variety	Days to Head	Plant Height	Test Weight	Protein	Grain Yield			Average Yield	
					1998	1999	2000	2 year	3 year
		inches	lbs/bu	%	bu/ac				
Mountrail	70	34	60.4	14.2	48.9	48.5	54.6	51.6	50.7
Ben	69	36	61.9	14.4	47.6	50.7	49.8	50.2	49.4
Maier	69	33	61.3	14.6	48.8	45.0	52.3	48.6	48.7
Lebsock	68	33	61.5	14.3		45.4	50.4	47.9	
Plaza	70	29	59.8	13.7		44.5	50.3	47.4	
# of locations	2	11	11	11	9	10	11	21	30

Locations: Hettinger, Dickinson, Scranton, Regent, Selfridge, New Leipzig, Mandan, Hannover, Beulah, Glen Ullin & Wibaux, MT.

Foliar Diseases - Durum **Hettinger**

Observations by **Amy Dukart**, NDSU Extension Summer Intern

Variety	Leaf Rust		Tan Spot		Septoria	
	1999	2000	1999	2000	1999	2000
	% Flag Leaf Infection					
Mountrail	0	0	15	5	0	3
Ben	0	0	5	3	0	3
Plaza	0	0	5	5	0	3
Munich	0	0	15	3	0	3
Renville	1	0	15	3	0	3
Rugby	0	0	15	3	0	3
Lebsock	0	0	15	10	0	3
Maier	3	0	10	3	0	3
Monroe	0	0	20	5	0	3
Dressler	0	0	20	5	3	3
Belzer	0	0	20	3	0	3
Plenty	2	0	15	5	0	5
AC Melita	0	0	10	5	3	5
Kari	0	0	10	3	5	5
AC Avonlea		0		5		5

Planting Date: April 14, 1999, April 10, 2000
Date of Observation: July 22, 1999, July 10, 2000
Previous crop: 1999 = Field peas, 2000 = Soybeans.

Table 1. 2001 North Dakota barley variety descriptions.

Variety	Use[1]	Origin	Year Released	Awn Type[2]	Aleurone Color	Height	Straw Strength	Relative Maturity	Reaction to Disease[3]			
									Stem Rust	Loose Smut	Spot Blotch	Net Blotch
Six-row												
Azure	M/F	ND	1982	S	blue	med.	m. strg.	m. early	S	S	MR-R	MS-S
Excel	M/F	MN	1990	S	white	m. short	strg.	med.	S	S	MR-R	MS-S
Foster	M/F	ND	1995	S	white	m. short	strg.	med.	S	S	MR-R	MS-S
Hazen	F	ND	1984	S	white	med.	m. strg.	med.	S	S	MR-R	MS-S
Morex	M/F	MN	1978	S	white	tall	med.	early	S	S	MR	S
Robust	M/F	MN	1983	S	white	med	m.strg.	med.	S	S	MR-R	MS-S
Stander	M/F	MN	1993	S	white	m. short	v.strg.	m. late	S	S	MR-R	MS-S
MNBrite*	F	MN	1997	S	white	tall	med	early	S	S	MR-R	MS-S
Lacey	F†	MN	1999	S	white	m. short	strg.	med.	S	S	MR-R	MS-S
Drumond	F†	ND	2000	S	w	m. short	v strg	med	S	S	MR-R	MS-S
Legacy	F†	BARI	2000	S	w	med	strg	m. late	S	S	MR-R	MS-S
Two-row												
Bowman	F	ND	1984	S	white	m.short	med.	early	S	S	MS-S	S-MS
Conlon[4]	M/F	ND	1996	S	white	m.short	med.	early	S	S	MS-MR	MR-R
Gallatin	F	MT	1986	R	white	med.	med.	late	S	S	MS	MS
Harrington[5]	F	Can.	1981	R	white	med.	m.weak	v.late	S	S	S	MR-MS
Logan	F	ND	1995	S	white	med.	strg.	med.	S	S	MS-MR	MR
Stark	F	ND	1991	S	white	m.tall	med.	late	S	S	S-MS	MS-S
Merit[5]	F	AB	1998	R	white	med	m.weak	v.late	S	S	MS	MR
Specialty												
Wanubet	SP	MT	1990	R	white	med.	weak	late	S	S	S	S

† Malting designation pending.
* Moderately resistant to Fusarium head blight.
1 M = malting; F = feed; SP = special uses (hulles).
2 Rough or smooth awned.
3 R = resistant; MR = moderately resistant; MS = moderately susceptible; S = susceptible; N/A = not available.
4 Lower DON accumulation than other varieties tested.
5 Recommended as a malting barley in western US.

2000 Barley - Continuously Cropped No-till — **Hettinger**

Variety	Days to Head	Plant Height	Test Weight	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
		inches	lbs/bu	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
2 Row								
Logan	70	32	49.4	128.9	110.4	77.2	93.8	105.5
Conlon	72	33	49.5	132.8	96.3	77.8	87.0	102.3
Stark	73	34	49.7	101.8	92.4	72.6	82.5	88.9
Bowman	72	33	48.8	103.3	87.9	71.7	79.8	87.6
Harrington	83	34	47.0	100.0	91.4	70.1	80.8	87.2
Merit	83	30	44.8		115.5	78.2	96.8	
6 Row								
Excel	73	36	46.2	128.2	103.0	83.9	93.4	105.0
B2978	75	35	45.9	121.8	93.3	80.2	86.8	98.4
Drummond	72	36	47.0	115.3	96.8	82.2	89.5	98.1
Robust	74	40	48.1	102.6	87.0	69.1	78.0	86.2
Morex	74	37	47.6		105.2	84.5	94.8	
Stander	74	36	47.8		97.9	85.9	91.9	
Lacey	72	35	48.0		93.4	84.1	88.8	
Foster	74	36	45.9		99.1	77.4	88.2	
Trial Mean	74	35	47.5	113.4	98.6	79.1	--	--
C.V. %	1.5	4.1	1.3	6.4	7.5	6.6	--	--
LSD .05	2	2	0.9	10.3	10.5	7.4	--	--
LSD .01	2	3	1.2	13.8	14.0	9.9	--	--

Planting Date: April 10, 2000
Harvest Date: July 31, 2000
Seeding rate: 750,000 live seeds/A (approx. 1.4 bu/A).
Previous Crop: 1998 = fallow, 1999 = field pea, 2000 = soybean.
Notes: Minor hail damage. Moderate Puma herbicide injury.

Barley - Recrop — **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Protein	% Plump	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Returns	Average Yield 2 Year	Average Yield 3 Year
			in	lbs/bu	%	>6/64	bu/ac	bu/ac	bu/ac	$/ac	bu/ac	bu/ac
Six Row												
B 2978	61	8,962	24	45.8	15.1	96.9	101.4	84.5	55.1	62.54	69.8	80.3
Drummond	60	8,264	22	45.0	16.2	96.5	95.7	91.0	45.0	49.93	68.0	77.2
Excel	60	9,217	23	46.0	15.3	97.7	103.2	94.6	58.9	66.99	76.8	85.6
Foster	60	8,402	22	42.6	14.8	96.5	98.5	94.2	54.1	54.52	74.1	82.3
Lacey	60	9,018	19	47.6	15.3	96.7	--	87.6	51.2	60.51	69.4	--
MN Brite	64	10,102	21	50.1	18.0	92.5	117.0	84.1	50.0	59.58	67.1	83.7
Morex	59	11,265	24	44.5	15.7	91.4	86.8	82.8	43.3	48.05	63.0	71.0
Robust	59	8,190	23	48.1	15.5	96.2	89.2	82.8	51.6	60.58	67.2	74.5
Stander	60	8,858	22	49.7	14.9	97.0	104.0	94.3	55.6	65.71	74.9	84.6
Two Row												
Bowman	60	8,142	22	52.0	16.8	97.4	72.5	79.0	43.2	52.21	61.1	64.9
Conlon	57	8,117	22	48.7	16.1	97.4	94.4	83.9	41.6	48.55	62.7	73.3
Harrington	63	9,088	21	49.4	16.0	90.4	75.9	73.3	46.4	54.25	59.8	65.2
Logan	60	8,825	22	49.8	15.4	94.3	103.6	90.6	46.1	54.57	68.3	80.1
Merit	61	8,871	22	46.5	15.5	96.0	99.0	80.6	45.6	52.70	63.1	75.1
Stark	60	8,831	25	51.9	16.5	95.7	85.6	89.3	51.3	61.54	70.3	75.4
Trial Mean	60	8,993	22	47.3	15.8	95.7	95.0	86.8	49.5	56.59	--	--
C.V. %	1.1	15.1	7.4	3.5	--	1.0	5.7	4.6	11.2	12.6	--	--
LSD .05	1	1,923	2	2.4	--	2.1	7.7	5.7	7.8	10.08	--	--

Planting Date: April 19
Harvest Date: August 1
Returns were calculated by multiplying the 2000 yields by the price paid for feed barley minus the test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8. The price paid on this date was $1.15/bu, assuming that the test weight was heavier than 45 lb/bu. Grain with a test weight of 45 lb/bu was discounted $.03/bu, with an additional discount of $.04/bu per pound down to 42 lb/bu. Below 42 lb/bu, an additional discount of $.05/bu occurred per pound.

2000 Barley - Continuously Cropped No-till — **Scranton**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
	inches	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Bowman	29	51.9	11.1	38.4	47.0	68.1	57.6	51.2
Stark	31	52.6	10.9	46.5	36.3	69.3	52.8	50.7
Conlon	28	51.9	10.4	34.6	47.4	63.9	55.6	48.6
Robust	37	51.7	11.8			63.0		
Trial Mean	31	52.0	11.0	41.3	47.5	66.1	--	--
C.V. %	3.6	0.5	--	10.0	17.6	5.4	--	--
LSD .05	2	0.5	--	6.3	13.0	NS	--	--

Planting Date: April 11, 2000 — Harvest Date: August 9, 2000
Seeding rate: 750,000 live seeds/A (approx. 1.4 bu/A).
Previous Crop: 1998 & 99 = HRSW, 2000 = HRWW
NS = no statistical difference between varieties.

2000 Barley - Continuously Cropped No-till — **Regent**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
	inches	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Stark	30	51.4	12.0	71.2	87.8	66.5	77.2	75.2
Conlon	26	49.4	12.0	67.6	92.6	64.9	78.8	75.0
Bowman	26	49.8	12.9	58.8	95.5	68.3	81.9	74.2
Robust	31	48.6	13.4			63.1		
Trial Mean	28	49.8	12.6	67.3	92.6	65.7	--	--
C.V. %	6.7	0.5	--	6.4	5.7	10.2	--	--
LSD .05	NS	0.5	--	6.6	NS	NS	--	--

Planting Date: April 12, 2000 — Harvest Date: August 3, 2000
Seeding rate: 750,000 live seeds/A (approx. 1.4 bu/A).
Previous Crop: 1998 & 99 = HRSW, 2000 = HRWW
NS = no statistical difference between varieties.

2000 Barley - Continuously Cropped No-till — **New Leipzig**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
	inches	lbs/bu	%	bu/ac				
Bowman	24	49.5	10.6	60.3	81.7	40.0	60.8	60.7
Stark	25	50.4	9.6	62.6	76.1	40.5	58.3	59.7
Conlon	23	48.8	9.9	54.2	76.5	36.1	56.3	55.6
Robust	24	48.8	10.2			38.6		
Trial Mean	24	49.4	10.1	59.6	78.0	38.8	--	--
C.V. %	3.3	0.7	--	5.6	7.7	9.7	--	--
LSD .05	NS	0.5	--	NS	NS	NS	--	--

Planting Date: April 12, 2000 — Harvest Date: August 3, 2000
Seeding rate: 750,000 live seeds/A (approx. 1.4 bu/A).
Previous Crop: 1998 & 99 = HRSW, 2000 = HRWW
NS = no statistical difference between varieties.

2000 Barley - Continuously Cropped No-till — **Selfridge**

Variety	Plant Height	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
	inches	lbs/bu	%	bu/ac				
Stark	35	50.7	10.6	94.6	73.7	51.9	62.8	73.4
Conlon	36	49.2	10.8	88.0	67.6	56.0	61.8	70.5
Bowman	35	49.8	11.3	83.0	71.8	52.4	62.1	69.1
Robust	40	48.8	11.7			57.0		
Trial Mean	36	49.6	11.1	88.5	71.0	54.3	--	--
C.V. %	7.3	0.9	--	5.6	8.4	11.1	--	--
LSD .05	NS	0.7	--	7.5	NS	NS	--	--

Planting Date: April 13, 2000 — Harvest Date: August 10, 2000
Seeding rate: 750,000 live seeds/A (approx. 1.4 bu/A).
Previous Crop: 1998 = HRSW, 1999 = Sunflower, 2000 = HRWW
NS = no statistical difference between varieties.

Barley - Fallow	Wibaux, MT

Variety	Test Weight	Grain yield 1999	Grain yield 2000	Returns
	lbs/bu	bu/ac		$/ac
Excel	46.0	-	49.2	56.57
Foster	46.5	74.0	44.9	51.67
Lacey	48.5	-	50.6	58.23
Robust	48.0	-	26.7	30.65
Trial Mean	47.3	58.1	42.9	49.28
C.V. %	0.7	19.2	13.3	13.3
LSD .05	0.6	NS	11.3	13.05

Planting Date: April 27 Harvest Date: August 10
Returns were calculated by multiplying the 2000 yields by the price paid for feed barley minus the test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8. The price paid on this date was $1.15/bu, assuming that the test weight was heavier than 45 lb/bu.

Barley in Southwestern North Dakota
Combined Means

Variety	Days to Head	Plant Height	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
		inches	lbs/bu	%	bu/ac				
Bowman	66	28	50.3	12.5	69.6	77.2	57.3	67.2	68.0
Stark	66	30	51.1	11.9	67.9	75.9	58.7	67.3	67.5
Conlon	64	28	49.6	11.8	68.2	77.4	56.7	67.0	67.4
Robust	66	32	49.0	12.5			57.1		
# of locations	2	6	6	5	10	6	6	12	22

Locations: Hettinger, Dickinson, Scranton, Regent, Selfridge, & New Leipzig.

Table 4. 2001 North Dakota Oat Variety Descriptions.

							Reaction to Diseases			Quality Factors		
Variety*	Origin	Year Released	Grain Color	Height	Straw Strength	Maturity[2]	Stem rust[1]	Crown rust	Barley Y. Dwf.[4]	Rel. Yield	bu/Wt	Protein[3]
Hytest	SD	1986	white	tall	m.strg.	E	S	MS	S	fair	v.good	H
Prairie	WI	1991	white	short	strg.	E	S	S	T	good	good	M
Premier	MN	1990	yellow	short	med.	M	R	MS	MT	v.good	v.good	H
Milton	MN	1994	yellow	med.	strg.	L	S	MS	MT	v.good	v.good	M
Jerry	ND	1994	white	tall	strg.	M	R	MS	MT	v.good	v.good	M
Newdak	ND/NY	1990	white	med.	strg.	M	R	S	T	v.good	good	M
Jim	MN	1995	yellow	med.	strg.	M	S	MS	MT	good	good	M
Brawn	IL	1993	yellow	short	v.strg.	M	S	S	T	v.good	good	M
Killdeer	ND	2000	white	med	strong	M	R	MR	MT	v.good	good	M
Richard	MN	2000	yellow	tall	strong	M	S	MR	T	v.good	good	M
Valley	ND	1988	ivory	short	strg.	L	R	MS	MT	v.good	v.good	M
Whitestone	ND	1994	white	short	strg.	L	R	MS	MT	v.good	good	L
Otana	MT	1977	white	m.tall	m.weak	L	S	S	S	v.good	v.good	ML
CDC Boyer	Sask. Value Added S.	1994	white	tall	m.strg	L	S	MR	S	good	v.good	ML
Jud	ND	1997	ivory	tall	med.	L	R	MR	T	v. good	good	MH
Troy	SD	1991	ivory	tall	m.strg.	L	S	MS	T	good	good	M
AC Belmont	Can.	1993	naked	med.	strg.	L	R	S	MT	good	v.good	M
CDC Pacer	Sask. Value Added S.	1996	white	tall	m.strg	L	S	S	S	good	good	L
Paul	ND	1994	naked	v.tall	strg.	L	R	R-MR	T	v.good	good	H
AC Medallion	Can. Cargill	1997	white	tall	med.	L	R	R	MT	good	good	ML
Dumont	Can.	1982	white	m.tall	m.weak	L	R	S	MS	good	good	ML
AC Preakness	Can. Proven Seed	1996	white	tall	strong	L	R	S	M	good	good	L
Bay	WI	1993	yellow	med.	v.strg.	L	S	MR-S	T	good	fair	H
Youngs	ND	1999	white	med.	strong	L	R	MR	MT	v.good	good	M
AC Assiniboia	Can Proven Seed	1997	red	med	strong	L	R	R	T	v. good	good	ML
Triple Crown	Canterra	1998	white	tall	strong	L	S	R	S	good	good	L
Loyal	ND	2000	ivory	tall	m.strong	L	MS	R-MR	T	v.good	good	MH
Vista	WI	2000	yellow	tall	strong	L	S	R	MT	v.good	good	M
Gem	WI	1996	yellow	tall	strong	L	S	R	MT	good	good	MH
Belle	WI	1995	yellow	tall	strong	L	S	R	MT	good	good	M
Ebeltoft	ND	1999	white	tall	strong	VL	R	MR	S	good	v.good	M
AC Marie	Can.	1992	white	tall	weak	VL	R	S	MT	fair	fair	ML

* Varieties listed in order of maturity.

1 Stem rust races most prevalent now. S = susceptible; M = moderately; R = resistant; VS = very susceptible.

2 E = early; M = medium; L = late.

3 H = high; M = medium; L = low; V = very; VL = very low.

4 S= susceptible; MS = moderately susceptible; MT = moderately tolerant; T = tolerant. Varieties rated MT or T have a relatively good degree of protection against barley yellow dwarf virus.

2000 Oats - Continuously Cropped No-till — Hettinger

Variety	Days to head	Plant Height	Test Weight	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
		inches	lbs/bu	bu/ac	bu/ac	bu/ac		
Killdeer	64	38	38.4	150.5	155.3	108.2	131.8	138.0
Whitestone	67	39	38.2	131.2	157.1	114.3	135.7	134.2
Ebeltoft	70	37	37.6	126.7	151.7	109.7	130.7	129.4
Monida	70	39	35.0	135.2	142.8	95.9	119.4	124.6
Brawn	63	38	37.5	135.3	132.1	96.0	114.0	121.1
Otana	67	44	38.2	126.5	131.0	100.6	115.8	119.4
Youngs	68	44	37.8	126.1	139.6	90.4	115.0	118.7
Jerry	63	42	39.6	127.6	137.2	90.8	114.0	118.5
AC Assiniboia	69	38	37.2	127.2	127.7	93.9	100.8	116.3
Troy	66	44	39.0	122.9	128.9	91.9	110.4	114.6
AC Medallion	68	42	36.0	123.2	116.4	91.5	104.0	110.4
Jud	67	44	38.6	121.2	115.8	91.2	103.5	109.4
CDC Boyer	69	42	36.2	126.1	108.4	78.3	93.4	104.3
Hytest	63	44	39.9	121.2	94.4	65.1	79.8	93.6
Paul*	71	41	43.0	88.5	70.7	55.8	63.2	71.7
Gem	64	39	37.7		129.8	92.5	111.2	
Triple Crown	73	40	36.2		124.4	92.8	108.6	
Belle	71	39	37.8		121.5	87.8	104.6	
CDC Pacer	66	42	36.0		114.0	84.2	99.1	
Loyal	68	44	38.6			97.9		
Riser	55	36	37.0			58.5		
Trial Mean	67	41	38.3	124.9	128.4	91.2	--	--
C.V. %	1.3	5.1	2.0	5.9	11.8	10.5	--	--
LSD .05	1	3	1.1	10.3	21.3	13.5	--	--
LSD .01	2	4	1.5	13.7	28.2	17.9	--	--

* = Naked (hulless) type.
Planting Date: April 11, 2000
Harvest Date: July 31, 2000
Seeding Rate: 750,000 live seeds/A (approx. 1.7 bu/A).
Previous Crop: 1998 = fallow, 1999 & 2000 = soybean.

Oat - Fallow **Dickinson, ND**

Variety	Days to Head	Seeds per Pound	Plant Height	Test Weight	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Returns	Average Yield 2 Year	Average Yield 3 Year
			in	lbs/bu	bu/ac	bu/ac	bu/ac	$/ac	bu/ac	bu/ac
ACAssiniboia	68	12,111	34	35.5	87.6	112.5	122.6	82.64	117.6	107.6
ACMedallion	68	11,208	36	37.3	93.2	116.1	123.6	90.83	119.9	111.0
Belle	67	13,982	30	38.6	--	118.1	106.4	84.96	112.2	--
Brawn	65	10,406	30	36.7	106.3	131.5	131.5	98.21	131.5	123.1
CDCBoyer	68	10,481	36	36.1	96.5	111.1	128.6	90.61	119.9	112.1
CDCPacer	68	10,666	36	38.3	--	125.0	131.2	103.55	128.1	--
Ebeltoft	69	12,232	32	37.0	101.0	133.5	142.1	104.72	137.8	125.5
Gem	64	12,784	33	37.7	--	115.4	118.8	89.27	117.1	--
Hytest	64	11,611	38	42.2	85.7	115.5	87.2	74.68	101.4	96.1
Jerry	63	11,846	34	40.0	89.0	122.0	85.3	68.07	103.7	98.8
Jud	69	11,281	38	37.0	96.2	107.3	127.2	95.73	117.3	110.2
Killdeer	65	13,266	32	38.9	104.6	128.9	125.4	102.40	127.1	119.6
Loyal	68	14,922	37	40.2	--	116.5	124.4	103.66	120.5	--
Monida	69	14,414	33	38.8	100.4	134.2	147.3	122.65	140.8	127.3
Otana	68	12,521	37	39.6	108.7	134.9	130.0	108.32	132.5	124.5
Paul*	70	13,673	36	43.6	61.6	64.5	88.6	--	76.5	71.6
TripleCrown	72	12,207	35	36.2	103.6	121.2	131.4	95.82	126.3	118.7
Troy	68	15,036	37	38.4	99.9	127.7	134.6	107.82	131.2	120.7
Whitestone	68	15,413	31	38.3	101.3	131.1	140.7	112.05	135.9	124.4
Youngs	68	13,031	37	36.2	98.7	135.1	137.3	97.56	136.2	123.7
Trial Mean	67	12,676	35	38.7	95.2	119.7	123.5	98.09	--	--
C.V. %	0.9	12.5	5.0	3.4	6.5	6.2	6.7	8.5	--	--
LSD .05	1	2,230	2	1.9	8.8	10.4	11.7	11.74	--	--

Planting Date: April 13
Harvest Date: August 2
* Naked
Returns were calculated by multiplying the 2000 yield by test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8. The price paid on this date was $.80/bu, assuming that the test weight was heavier than 37 lb/bu. Grain with a test weight of 37 lb/bu was discounted $.04/bu, with an additional discount of $.04/bu per pound down to 30 lb/bu. Below 30 lb/bu, an additional discount of $.07/bu occurred per pound.

2000 Regent Oats
Continuously Cropped No-till

Variety	Plant Height	Test Weight	Grain Yield
	inches	lbs/bu	bu/ac
Killdeer	29	36.8	130.4
Youngs	35	38.6	127.1
Ebeltoft	30	37.6	118.3
Jerry	34	39.7	117.5
Loyal	33	38.7	115.8
Jud	34	38.6	101.7
Paul*	35	43.6	69.6
Trial Mean	33	39.1	111.5
C.V. %	5.4	0.3	5.6
LSD .05	NS	0.2	15.3
LSD .01	NS	0.4	23.2

Planting Date: April 12 Harvest Date: August 3
Seeding rate: 750,000 live seeds/A (approx. 1.7 bu/A).
Previous Crop: HRWW
* Naked (hulless) type.
NS = no statistical difference between varieties.

2000 Oats - Continuously Cropped No-till **New Leipzig**

Variety	Plant Height	Test Weight	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
	inches	lbs/bu	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Jud	35	36.6	94.4	76.2	78.5	77.4	83.0
Jerry	31	36.8	74.7	75.7	57.9	66.8	69.4
Paul*	32	43.0	68.3	41.6	41.3	41.4	50.4
Ebeltoft	25	36.4		101.5	78.8	90.2	
Youngs	34	36.4		83.2	81.0	82.1	
Killdeer	29	37.5			87.9		
Loyal	33	38.7			78.1		
Trial Mean	31	37.9	87.5	75.6	71.9	--	--
C.V. %	7.1	2.0	7.6	12.3	17.7	--	--
LSD .05	5	1.1	9.9	14.1	18.8	--	--
LSD .01	NS	1.5	13.6	19.6	25.7	--	--

Planting Date: April 12, 2000 Harvest Date: August 3, 2000
Seeding rate: 750,000 live seeds/A (approx. 1.7 bu/A).
Previous Crop: 1998 & 99 = HRSW, 2000 = HRWW
* Naked (hulless) type.
NS = no statistical difference between varieties.

Oats - Continuously Cropped No-till — **Selfridge**

Variety	Plant Height	Test Weight	Grain Yield 1997	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
	inches	lbs/bu	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Jud	51	38.7	48.7	35.6	96.6	66.1	60.3
Jerry	46	38.5	41.8	32.0	100.0	66.0	60.0
Paul*	49	45.6	26.9	22.0	67.9	45.0	38.9
Ebeltoft	42	36.7		38.4	116.9	77.6	
Youngs	49	37.7		26.1	107.9	67.0	
Killdeer	42	37.3			109.0		
Loyal	47	39.0			97.7		
Trial Mean	46	39.1	53.0	30.8	99.5	--	--
C.V. %	2.9	1.4	23.1	43.4	7.8	--	--
LSD .05	3	0.8	18.3	NS	11.5	--	--
LSD .01	5	1.1	NS	NS	15.7	--	--

Planting Date: April 13, 2000 Harvest Date: August 10, 2000
Seeding rate: 750,000 live seeds/A (approx. 1.7 bu/A).
Previous Crop: 1997 = HRSW, 1999 = Sunflower, 2000 = HRWW
* Naked (hulless) type.
NS = no statistical difference between varieties.

Oats - Continuously Cropped No-till — **Mandan**

Variety	Plant Height	Test Weight	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
	inches	lbs/bu	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Jud	52	34.5	112.9	91.0	97.0	94.0	100.3
Jerry	47	34.6	125.2	58.7	89.4	74.0	91.1
Paul*	56	41.3	93.3	48.3	66.4	57.4	69.3
Ebeltoft	46	33.9		99.2	110.2	104.7	
Youngs	53	34.1		84.1	110.0	97.0	
Killdeer	45	33.7			121.1		
Loyal	53	36.5			97.2		
Trial Mean	50	35.5	116.9	76.3	98.8	--	--
C.V. %	2.1	1.9	7.8	5.9	10.4	--	--
LSD .05	3	1.0	13.6	8.3	15.2	--	--
LSD .01	4	1.4	18.7	11.9	20.7	--	--

Planting Date: April 13, 2000 Harvest Date: August 10, 2000
Seeding rate: 750,000 live seeds/A (approx. 1.7 bu/A).
Previous Crop: 1998 = HRSW, 1999 = Rye, 2000 = Barley
* Naked (hulless) type.

Hannover Oat - Recrop — **Dickinson, ND**

Variety	Seeds per Pound	Plant Height	Test Weight	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Returns	Average Yield 2 Year	Average Yield 3 Year
		in	lbs/bu	-------bu/ac-------			$/ac	----bu/ac----	
Ebeltoft	12,325	42	34.2	--	25.7	167.8	105.35	96.7	--
Killdeer	14,024	35	37.4	--	--	160.4	112.01	--	--
Triple Crown	12,924	49	34.9	--	--	151.2	103.10	--	--
Whitestone	14,318	30	32.8	71.5	27.7	135.1	71.61	81.4	78.1
Youngs	12,054	49	32.8	--	19.8	139.1	80.63	79.5	--
Trial Mean	13,129	41	34.4	70.3	23.9	150.7	94.54	--	--
C.V. %	8.1	20.5	3.6	9.4	18.0	8.6	16.5	--	--
LSD .05	NS	NS	2.4	9.9	NS	NS	NS	--	--

Planting Date: May 3 Harvest Date: August 21

Beulah Oat - Recrop — **Dickinson, ND**

Variety	Seeds per Pound	Plant Height	Test Weight	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Returns	Average Yield 2 Year	Average Yield 3 Year
		in	lbs/bu	-------bu/ac-------			$/ac	----bu/ac----	
Ebeltoft	16,280	29	31.8	--	27.7	83.9	50.50	55.8	--
Killdeer	15,722	26	33.8	--	--	78.5	53.73	--	--
Triple Crown	21,646	33	27.5	--	--	83.2	38.22	--	--
Whitestone	15,716	28	33.4	46.6	26.5	91.1	59.52	58.8	54.7
Youngs	14,146	33	32.0	--	31.2	84.8	51.76	58.0	--
Trial Mean	16,702	30	31.7	39.1	25.0	84.3	50.75	--	--
C.V. %	30.8	5.7	5.5	17.9	28.1	15.6	20.7	--	--
LSD .05	NS	3.2	3	NS	NS	NS	NS	--	--

Planting Date: May 3 Harvest Date: August 14

Returns were calculated by multiplying the 2000 yield by test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8. The price paid on this date was $.80/bu, assuming that the test weight was heavier than 37 lb/bu. Grain with a test weight of 37 lb/bu was discounted $.04/bu, with an additional discount of $.04/bu per pound down to 30 lb/bu. Below 30 lb/bu, an additional discount of $.07/bu occurred per pound.

Glen Ullin Oat - Recrop — **Dickinson, ND**

Variety	Seeds per Pound	Plant Height	Test Weight	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Returns	Average Yield 2 Year	Average Yield 3 Year
		in	lbs/bu	-------bu/ac-------			$/ac	----bu/ac----	
Ebeltoft	13,910	33	33.0	--	86.8	146.8	91.12	116.8	--
Killdeer	14,800	32	34.6	--	--	159.0	109.50	--	--
Triple Crown	13,383	41	32.0	--	--	146.2	85.04	--	--
Whitestone	14,423	35	33.0	97.2	67.7	160.8	101.86	114.2	108.6
Youngs	11,875	25	32.3	--	88.7	148.3	88.39	118.5	--
Trial Mean	13,678	33	33.0	90.0	74.6	152.2	95.18	--	--
C.V. %	3.7	13.7	1.7	6.1	12.5	5.5	7.0	--	--
LSD .05	946	9	1.1	8.2	17.6	NS	12.47	--	--

Planting Date: May 3 Harvest Date: August 16

Oat - Fallow — **Wibaux, MT**

Variety	Test Weight	Grain yield 1999	Grain yield 2000	Returns
	lbs/bu	bu/ac		$/ac
Youngs	37.0	66.5	74.7	57.77
Killdeer	37.3	--	70.5	54.44
Whitestone	37.3	--	64.4	49.59
Ebeltoft	36.3	36.7	62.4	47.42
Triple Crown	37.3	--	59.1	46.48
HyTest	40.0	--	47.9	38.35
Paul*	43.3	46.0	40.1	--
Trial Mean	38.4	56.3	59.9	46.59
C.V. %	2.1	16.6	15.0	13.6
LSD .05	1.4	17.6	16.0	11.26

* Naked oat.

Planting Date: April 27 Harvest Date: August 10

Returns were calculated by multiplying the 2000 yield by test weight discount paid at the Southwest Grain Terminal located at Gladstone on September 8. The price paid on this date was $.80/bu, assuming that the test weight was heavier than 37 lb/bu. Grain with a test weight of 37 lb/bu was discounted $.04/bu, with an additional discount of $.04/bu per pound down to 30 lb/bu. Below 30 lb/bu, an additional discount of $.07/bu occurred per pound.

Oats in Southwestern North Dakota
Combined Means

Variety	Days to Head	Plant Height	Test Weight	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
		inches	lbs/bu	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Jud	68	42	37.3	89.5	79.7	98.7	89.2	89.3
Jerry	63	39	38.2	89.7	77.9	90.2	84.0	85.9
Paul*	70	42	43.4	65.5	42.0	61.4	51.7	56.3
Ebeltoft	70	35	35.5		76.9	113.7	95.3	
Youngs	68	40	35.5		74.5	110.1	92.3	
Killdeer	64	34	36.6			115.0		
Loyal	68	41	38.6			101.8		
# of locations	2	9	10	7	10	10	20	27

*Naked (hulless) type.
Locations: Hettinger, Dickinson, Regent, Selfridge, Mandan, New Leipzig, Glen Ullin, Hannover, Beulah & Wibaux, MT.

Table 1. 2000 Hard Red Winter Wheat Variety Descriptions

Variety	Agent or Origin	Year	Quality	Leaf rust[1]	Stem rust[1]	Maturity	Straw strength	Height	Winter[a] hardiness
Roughrider	ND	1975	Good	S	R[3]	med.	m. strong	med.	good
Norstar	Can.	1977	Average	S	S	late	med.	tall	good
Winridge	MT	1980	V. Poor	S	S	med.	strong	med.	poor
Rita	SD	1980	Average	MS	MR[2]	early	strong	med.	fair
Rose	SD	1981	Poor	S	MS[2]	early	v. strong	short	fair
Norwin*	MT	1983	Poor	S	MS	med.	strong	v.short	fair
Agassiz	ND	1983	Average	S	R	med.	med.	med.	good
Siouxland	NE	1984	Poor	MR	R	early	strong	med.	poor
Seward	ND	1987	Poor	S	R	med.	m. strong	med.	good
Abilene*	AgriPro	1987	Average	S	MR	early	strong	v.short	poor
Judith	MT	1988	Average	S	S	med.	strong	med.	fair
Arapahoe	NE	1989	Poor	MS	MR	med.	med.	med.	fair
CDC Kestrel	Can.	1994	Poor	S	S	med.	m. strong	med.	good
Elkhorn	ND	1995	Average	MR	R[4]	med.	med.	med.	good
Erhardt	MT	1996	NA	S	R	med.	strong	med	good
McGuire	MT	1996	NA	S	R	m. early	strong	m. tall	fair
Rampart**	MT	1996	NA	S	R	med.	strong	med.	poor
AC	Can.	1996	NA	S	S	med.	strong	med.	good
Nekota	SD/NE	1997	NA	MS	NA	early	v. strong	v. short	good
Alliance	NE	1997	NA	S	NA	early	strong	short	good
Crimson	SD	1997	NA	MS	NA	med.	m. strong	med.	NA
Tandem	SD	1997	Good	S	NA	early	med.	med.	NA
Windstar	NE	1997	NA	MS	NA	early	med.	med.	NA
Ransom	ND	1998	Good	R	NA	m. early	med.	med.	good
Harding	SD	1999	NA	MS/MR	NA	med	m. strong	med	good

[a] Varieties with less than good winterhardiness should be seeded only in tall stubble.

* Semidwarf, ** Saw fly resistant.

[1] R = resistant; MR = moderately resistant; MS = moderately susceptible; S = susceptible.

[2] Susceptible in artificially induced epidemics.

[3] Slow rusting type of resistance to race 15.

[4] Occasionally mixed with some susceptible plants.

2000 Hard Red Winter Wheat - Continuously Cropped No-till — Hettinger

Variety	Days to Head	Plant Height	Test Weight	Grain Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
	1/1	inches	lbs/bu	%	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Morgan	161	36	60.0	12.6	77.1	81.7	88.0	84.8	82.3
Ransom	158	35	59.4	13.4	62.3	71.8	93.3	82.6	75.8
Arapahoe	154	34	59.8	14.4	61.1	74.5	91.3	82.9	75.6
CDC Kestrel	160	37	59.0	13.0	66.5	73.0	86.9	80.0	75.5
Erhardt	158	32	60.5	15.3	65.2	71.3	82.5	76.9	73.0
Norstar	161	43	60.9	13.9	70.4	68.2	75.0	71.6	71.2
Nekota	151	33	60.6	13.4	50.6	71.6	91.2	81.4	71.1
Windstar	155	35	61.4	14.6	63.1	72.2	74.4	73.3	69.9
Crimson	159	36	62.1	15.5	61.4	66.9	81.0	74.0	69.8
Tandem	153	36	61.7	13.9	62.7	66.5	78.1	72.3	69.1
Alliance	151	31	60.4	12.4	47.3	68.6	89.2	78.9	68.4
Seward	162	41	60.8	14.2	68.0	67.3	67.3	67.3	67.5
Roughrider	159	40	61.2	14.7	58.2	69.1	72.5	70.8	66.6
Elkhorn	161	40	60.6	14.5	65.4	60.6	70.4	65.5	65.5
Agassiz	160	40	60.0	15.8	56.6	61.5	66.8	64.2	61.6
Harding	157	34	59.4	15.3		64.7	84.2	74.4	
CDC Falcon	159	34	60.2	13.9			99.6		
Daws*	162	33	53.7	12.6			74.0		
Eltan*	164	34	53.7	12.5			66.5		
Trial Mean	156	36	60.0	14.0	58.8	70.0	80.3	--	--
C.V. %	0.5	6.1	0.9	--	14.7	14.3	7.5	--	--
LSD .05	1	4	0.9	--	14.1	NS	9.8	--	--
LSD .01	2	5	1.2	--	18.8	NS	13.1	--	--

Planting Date: September 13, 1999 Harvest Date: July 27, 2000
Seeding Rate: 1.1 million live seeds/A (approx. 1.6 bu/A).
Previous Crop: Field Pea
No winter kill observed.
NS = no statistical difference between varieties.
*Soft white winter wheat

Hard Red Winter Wheat - Fallow **Dickinson,ND**

Variety	Days to Head	Winter Survival	Seeds per Pound	Height	Lodging Score	Test Weight	Protein	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Returns	Average Yield 2 Year	Average Yield 3 Year
	fr 1/1	%		in	0-9	lbs/bu	%	----------bu/ac----------			$/ac	-----bu/ac-----	
Agassiz	164	94	14,500	45	1.5	62.3	12.7	77.9	71.2	73.5	168.38	72.4	74.2
Alliance	159	96	15,571	31	0.0	61.8	11.2	69.9	61.6	75.9	144.26	68.8	69.1
Arapahoe	161	95	11,859	36	0.0	62.1	12.4	73.5	73.3	84.0	189.85	78.7	76.9
CDC Kestrel	164	95	15,681	37	0.0	60.3	11.9	83.6	81.5	77.9	166.60	79.7	81.0
Crimson	161	98	14,246	34	0.0	63.1	12.6	71.1	71.8	79.6	179.82	75.7	74.2
Daws*	165	96	15,973	31	0.0	54.4	10.4	--	--	54.9	--	--	--
Elkhorn	165	95	14,406	41	0.5	61.0	12.6	81.6	68.9	73.5	168.40	71.2	74.7
Eltan*	172	95	18,177	34	0.3	51.5	10.8	--	--	59.1	--	--	--
Erhardt	163	99	14,850	32	0.0	62.0	13.4	67.2	66.0	72.9	175.57	69.4	68.7
Nekota	159	95	12,384	29	0.0	59.9	12.6	69.2	61.6	75.1	163.37	68.4	68.6
Norstar	166	96	12,020	45	1.0	60.9	10.6	74.4	70.1	72.2	131.21	71.1	72.2
Ransom	162	98	13,975	37	0.3	61.2	12.0	78.7	67.3	79.0	169.14	73.2	75.0
Roughrider	163	95	11,530	40	0.5	62.0	13.3	70.9	59.1	70.2	167.11	64.7	66.7
Harding	162	95	13,729	37	0.0	63.0	12.4	71.4	78.0	82.6	186.74	80.3	77.3
Seward	166	95	15,011	45	1.5	61.6	10.9	83.8	76.0	68.7	127.75	72.3	76.2
Tandem	160	94	11,115	35	0.0	62.6	12.6	59.2	63.1	81.6	184.43	72.4	68.0
Windstar	160	96	15,186	38	0.5	62.5	12.2	77.6	63.5	76.1	167.48	69.8	72.4
Trial Mean	163	96	14,157	37	0.3	61.1	12.1	75.4	69.2	74.8	166.34	--	--
C.V. %	0.6	2.5	11.2	5.3	105.9	2.8	--	6.8	7.5	6.2	--	--	--
LSD .05	1	3	2,228	3	0.5	2.4	--	7.2	7.3	6.5	--	--	--

Planting Date: September 15, 1999
Harvest Date: August 1, 2000
Lodging 0 = No lodging, 9 = Completely flat
* Soft White
Returns were calculated by multiplying the 2000 yield by protein premium or discount paid at the Southwest Grain Terminal located at Gladstone on September 8. The price paid on this date was $2.20/bu, assuming that grain protein concentration was 12%. An additional $.03/bu was paid for each additional 0.2% increase in grain protein up to 14% protein. Grain was discounted $0.06/bu for each 0.2% reduction in grain protein from 12% to 11%, and $0.04/bu for each 0.2% reduction in grain protein from 11% to 10% below which no additional discount was assigned. Returns factored in discounts for grain with a test weight <60 lb/bu [-$0.01/bu per 1 lb/bu between 60 and 58 lb/bu; -$0.01/bu per 0.5 lb/bu between 58 and 57 lb/bu; -$0.02/bu per 0.5 lb/bu between 57 and 55 lb/bu; and -$0.04/bu per 0.5 lb/bu between 55 and 50 lb/bu; and -$0.06/bu per 0.5 lb/bu between 50 and 46 lb/bu].

North Dakota Winter Rye Variety Descriptions.

Variety	Origin	Year Released	Height	Straw Strength	Maturity	Seed Color	Seed Size	Test Weight	Winter hardiness
Dacold	ND	1989	med.	good[1]	v.late	bl-grn.	med.	low	good
Prima	Can	1984	tall	good	med.	blue	large	med.	v.good
Frederick	SD	1984	tall	fair	late	tan	med.	high	good
Musketeer	Can	1980	tall	good	m.early	blue	large	med.	v.good
Rymin	MN	1973	tall	v.good	late	grn-gray	large	high	fair[2]

1 Under certain environments lodging has been observed.
2 Varieties with fair winter hardiness should not be seeded on bare soil.

2000 Winter Rye - Continuously Cropped No-till — **Hettinger**

Variety	Days to Head	Plant Height	Test Weight	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
	1/1	inches	lbs/bu	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
Dacold	160	42	51.2	106.7	61.0	56.1	58.6	74.6
Prima	152	44	52.3	96.0	42.2	38.9	40.6	59.0
AC Rifle	157	32	51.1	83.3	44.9	34.6	39.8	54.3
Musketeer	150	45	53.1			46.8		
Trial mean	155	41	51.9	96.8	51.6	44.1	--	--
C.V. %	1.6	4.8	1.3	10.8	15.1	11.5	--	--
LSD .05	4	3	1.0	16.2	12.3	7.9	--	--
LSD .01	6	4	1.4	NS	NS	11.2	--	--

Planting Date: September 13, 1999
Harvest Date: August 2, 2000
Seeding rate: 1.1 million live seeds/A
No winter kill observed.
Previous crop: 1998 = fallow, 1999 = field pea, 2000 = soybean.
NS = no statistical difference between varieties.

Winter Rye - Fallow — **Dickinson,ND**

Variety	Days to Head	Winter Survival	Seeds per Pound	Plant Height	Lodging Score	Test Weight	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 Year	Average Yield 3 Year
	fr 1/1	%		in		lbs/bu	bu/ac				
AC Rifle	150	93	17,428	35	0.0	57.0	70.8	69.6	65.9	67.8	68.8
Dacold	152	94	15,453	46	0.8	57.2	96.0	88.8	102.1	95.5	95.6
Musketeer	144	89	15,782	51	4.8	60.8	--	--	76.5	--	--
Prima	148	96	15,070	49	2.5	58.8	76.8	72.5	74.9	73.7	74.7
Trial Mean	148	93	15,933	45	2.0	58.5	81.1	78.1	79.9	--	--
C.V. %	0.5	2.9	5.1	4.1	28.9	0.8	4.9	5.1	5.3	--	--
LSD .05	1	4	1,286	3	0.9	0.7	6.3	6.3	6.8	--	--

Planting Date: September 15, 1999 Harvest Date: August 1, 2000
Lodging 0 = No lodging, 9 = Completely flat

2000 Spring Triticale Continuously Cropped No-till — **Hettinger**

Variety	Days to Head	Plant Height	Lodg.	Test Weight	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
		inches	0-9*	lbs/bu	bu/ac				
Wapiti	73	49	1.2	56.0	23.1	40.8	42.2	41.5	35.4
Marvel	75	46	0.8	47.4	22.3	32.1	43.1	37.6	32.5
RSI 310	74	40	0.0	54.8		54.6	56.6	55.6	
Companion	74	50	1.5	56.2		39.3	44.2	41.8	
Lazer	74	49	1.0	56.1			44.1		
Trical 2700	78	47	0.0	50.8			43.8		
Trial Mean	75	47	0.8	53.5	21.7	40.5	45.7	--	--
C.V. %	0.7	2.5	48.0	0.8	19.5	5.8	11.3	--	--
LSD .05	1	2	0.5	0.6	NS	3.5	7.7	--	--
LSD .01	1	2	0.7	0.8	NS	4.8	10.6	--	--

Planting Date: April 10, 2000 Harvest Date: August 7, 2000
Seeding rate: 1 million live seeds/A.
Previous Crop: 1998 = fallow, 1999 = field pea, 2000 = soybean.
*Lodging: 0 = none, 9 = laying flat on ground.
NS = no statistical difference between varieties.
Notes: Moderate Puma herbicide injury in 1998 trial.

Brand	Variety	Plant Type*	Days to First Flower	Days to Last Flower	Days to Mature	Plant Height	Lodg.	Oil	Yield		
									1999	2000	2 year
						inches	0 - 9**	%	---- pounds per acre ---		
Interstate	Hyola 330	H	56	80	105	28	4	41.1	3302	2680	2991
Interstate	Hyola 401	H	56	81	106	33	1	42.0	3285	2647	2966
Croplan	CL2078	Syn	62	84	107	39	2	42.5	3390	2307	2848
Interstate	Hyola 420	H	58	82	106	34	2	42.4	2968	2420	2694
AgriTel	Ebony	OP	62	84	109	38	1	44.9	2819	2433	2626
Kaystar	KC701	H	62	83	107	37	2	44.1	2933	2260	2596
Interstate	Q2	OP	63	85	108	36	2	42.5	3012	2073	2542
Croplan	Hudson	OP	60	83	104	31	2	42.1	2810	1887	2348
Parsons	PSL98-112	OP	60	83	105	32	2	42.3	2573	1953	2263
Kaystar	KC007	OP	63	83	104	36	1	44.3	2837	1613	2225
AgriTel	LG3369	OP	60	84	107	32	3	44.8	2134	2287	2210
Limagrain	LG3366	OP	63	84	108	40	1	43.4		2353	
Seed-Link	Skyhawk	OP	60	84	107	36	2	43.2		2253	
LiBred	96-2393LL	OP,LL	62	85	108	39	2	44.0		2231	
Croplan	CL2070	H	62	85	107	37	1	42.8		2160	
Croplan	601	H	63	84	108	39	1	43.7		2140	
Pioneer	46A65	OP	59	83	104	31	2	42.0		2125	
Pioneer	45A03	OP	61	82	104	31	2	42.5		2120	
Croplan	Carrington	OP	61	85	106	34	2	46.1		2089	
Interstate	S8003	OP,IMI	60	82	104	31	2	40.6		2067	
Croplan	Goliath	OP	59	82	106	31	3	45.0		2047	
Limagrain	LG3311	OP	60	82	105	34	1	43.1		2040	
LiBred	280	OP	61	83	105	38	2	46.6		2020	
Pioneer	46A76	OP,IMI	63	84	108	40	0	43.2		1860	
Parsons	PSL02-202	OP	65	83	109	41	0	43.6		1805	
Trial Mean			61	83	106	35	2	43.3	2801	2159	--
C.V. %			0.7	0.7	1.1	6.2	43.5	1.8	11.7	12.8	--
LSD .05			1	1	2	3	1	1.1	461	392	--
LSD .01			1	1	2	4	1	1.5	611	522	--

* Plant Type: OP = Open Pollinated, H = Hybrid, Syn = Synthetic, LL = Liberty Link, IMI = Clearfield.
** Lodging: 0 = none, 9 = laying flat on ground.
Planting Date: April 10, 2000 Harvest Date: July 31, 2000
Seeding Rate: 7.5 lbs/acre Previous crop: 1999 = HRSW, 2000 = Field Pea.

2000 Roundup Ready Canola Variety Trial - No-till Recrop — **Hettinger**

Brand	Variety	Plant Type*	Days to First Flower	Days to Last Flower	Days to Mature	Plant Height	Lodg.	Oil	Yield		
									1999	2000	2 year
						inches	0 - 9**	%	---- pounds per acre ---		
Interstate	Hyola 357RR	H	59	82	105	31	2	42.3	3741	2720	3230
Monsanto	RiderR	OP	61	84	105	34	1	42.3	3434	2169	2802
AgriTel	LG3295	OP	61	85	106	28	4	40.7	3179	2313	2746
Croplan	Minot RR	OP	61	84	106	28	3	42.9	2854	2627	2740
AgriTel	LG3235	OP	59	83	104	27	3	41.2	3091	2227	2659
Pioneer	45A51	OP	62	86	108	30	2	45.4	3355	1927	2641
Cargill	LG3345	OP	60	84	105	26	3	43.2	2942	2133	2538
Proseed	SW RazoR	OP	61	84	106	28	3	42.8		2527	
AgriTel	LG3455	OP	62	84	106	34	2	44.2		2447	
Croplan	CL2061 RR	H	62	85	108	35	1	45.0		2387	
Proseed	Roughrider	OP	62	84	108	28	2	46.9		2353	
Interstate	Hyola 223RR	H	56	82	103	28	2	41.2		2347	
Monsanto	PR5338	OP	60	84	105	29	2	42.8		2140	
Monsanto	DKL2720	OP	61	84	107	30	3	41.0		2113	
Interstate	ConQuest	OP	63	85	106	34	1	42.3		2080	
LiBred	449RR	OP	60	83	104	30	2	40.8		2073	
LiBred	13.99RR	Syn	61	84	104	31	1	42.0		2036	
LiBred	4.99RR	H	60	84	104	31	1	40.8		2018	
Legend	LS296RR	OP	60	84	104	27	4	39.4		1840	
Interstate	Hyola 454RR	Syn	61	86	106	29	2	43.1		1833	
Trial Mean			61	84	106	30	2	42.6	3074	2214	--
C.V. %			0.9	0.8	1.5	10.3	42.5	3.2	7.4	20.0	--
LSD .05			1	1	2	4	1	1.9	324	NS	--
LSD .01			1	1	3	6	2	2.6	433	NS	--

* Plant Type: OP = Open Pollinated, H = Hybrid, Syn = Synthetic.
** Lodging: 0 = none, 9 = laying flat on ground.
Planting Date: April 10, 2000 Harvest Date: July 31, 2000
Seeding Rate: 7.5 lbs/acre Previous crop: HRSW

2000 Canola Seeding Rate-Recrop	Dickinson, ND

	Emergence	Plant Establishment	Plant Population	Days to Flower	Flower Duration	Plant Height	Weed Control
			plants/ft^2		days	in	%
Tillage (T)							
Conventional	Apr 27	Apr 29	8	58	19	32.1	90
None	Apr 26	Apr 29	9	58	19	32.0	95
Seeding rate (SR)							
5 plants/ft^2	Apr 27	Apr 30	4	59	20	32.6	87
10 plants/ft^2	Apr 26	Apr 29	6	58	19	32.4	94
15 plants/ft^2	Apr 26	Apr 29	10	58	19	31.3	94
20 plants/ft^2	Apr 26	Apr 29	13	58	19	31.9	95
Variety (V)							
Hyola 357 RR	Apr 26	Apr 28	9	57	18	30.1	94
LG 3295 OP	Apr 27	Apr 30	8	60	21	34.0	91
Mean	Apr 26	Apr 29	8	58	19	32.0	92
T	*	*	NS	*	NS	NS	*
SR	NS	NS	*	*	NS	NS	*
V	*	*	NS	*	*	*	*
T x SR	NS	NS	NS	NS	NS	NS	NS
T x V	NS	NS	NS	*	*	NS	NS
T x SR x V	NS	NS	NS	NS	NS	NS	NS

Planting Date: April 10
Harvest Date: August 1

2000 Canola Seeding Rate-Recrop	Dickinson, ND

	Yield	Oil	Test Weight	Seeds per Pound
	lbs/ac	%	lbs/bu	
Tillage (T)				
Conventional	1278.8	47	50.2	117,935
None	1402.9	46	50.1	117,660
Seeding rate (SR)				
5 plants/ft^2	1211.1	46	49.6	113,110
10 plants/ft^2	1327.4	47	50.3	118,003
15 plants/ft^2	1369.2	47	50.4	120,425
20 plants/ft^2	1455.7	47	50.4	119,653
Variety (V)				
Hyola 357 RR	1479.7	47	49.6	115,673
LG 3295 OP	1202.0	46	50.8	119,922
Mean	1340.9	47	50.2	122,149
T	*	NS	NS	NS
SR	*	NS	*	*
V	*	*	*	*
T x SR	NS	NS	NS	NS
T x V	NS	NS	NS	NS
T x SR x V	NS	NS	NS	NS

Planting Date: April 10
Harvest Date: August 1

2000 Canola Seeding Rate - No-till — **Hettinger**

Seeding Rate			– Plant Stand –										Yield		
lbs / acre	Seeds / foot	Plants / acre	Initial	Final	Days to Emerg.	Days to First Flower	Days to Last Flower	Days to Matur.	Plant Height	Lodg.*	Stem Diam**	1000 Kernel Weight	Oil	2000	1999	2 yr Avg.
		1000's	plants / sq foot		Days from planting				inches	0 - 9	inches	grams	%	lbs/ac		
Open Pollinated (LG3295)																
1.73	5	217.8	3.6	2.9	20	67	91	111	30	1.8	0.39	3.18	42.2	1073	2489	1781
3.46	10	435.6	6.0	5.0	20	66	90	110	32	2.5	0.38	3.02	41.3	1460	2738	2099
5.19	15	653.4	9.4	7.6	20	66	90	111	30	2.8	0.33	3.00	41.2	1613	2658	2136
6.92	20	871.2	10.7	10.3	20	66	90	110	31	3.0	0.28	3.08	41.1	1720	2702	2211
Hybrid (Hyola 357RR)																
2.34	5	217.8	4.9	4.7	20	66	86	111	32	1.0	0.37	3.05	43.0	1740	3040	2390
4.68	10	435.6	8.4	8.1	20	65	86	110	31	1.2	0.31	3.05	42.6	2073	3254	2664
7.02	15	653.4	11.3	10.9	20	64	86	111	32	1.8	0.25	3.20	42.5	2173	3476	2824
9.37	20	871.2	10.1	7.6	20	65	86	111	31	1.7	0.24	3.13	41.9	2080	3316	2698
C.V. %			33.7	33.7	0	0.5	0.8	0.5	4.2	31.4	20.2	4.4	1.4	13.7	9.4	
LSD .05			4.0	3.5	NS	1	1	NS	NS	0.9	NS	NS	0.9	350	408	
LSD .01			5.4	4.8	NS	1	1	NS	NS	1.2	NS	NS	NS	478	553	

Planting Date: April 24, 2000
Harvest Date: July 31, 2000
Previous Crop: Field pea
*Lodging: 0 = none, 9 = laying flat on ground.
** Stem diameter measured 3 inches above soil surface at harvest.

2000 Canola Dormant Seeded Trial **Dickinson, ND**

Hybrid	Seeding Rate	Seed Treatment	Planting Date	Plant Stand First[1]	Plant Stand Second[2]	Vigor First[1]	Vigor Second[2]	Flowering first	Flowering 90% complete
Hyola357	600,000	None	Spring	6	5	1	5	Jul 7	Jun 6
Hyola357	800,000	Benlate	Fall	3	2	5	4	Jul 11	Jun 7
Hyola357	600,000	Benlate	Fall	2	2	5	4	Jul 11	Jun 8
Hyola357	600,000	Extender	Fall	2	2	5	3	Jul 11	May 31
Minot	600,000	None	Fall	2	3	5	3	Jul 14	Jun 8
Minot	800,000	Benlate	Fall	1	3	5	2	Jul 13	Jun 9
Minot	600,000	None	Spring	5	2	3	5	Jul 9	Jun 7
Minot	600,000	Extender	Fall	2	4	5	2	Jul 13	Jun 9
Minot	600,000	Helix + Extender	Fall	2	4	5	3	Jul 11	Jun 8
Mean				3	3	4	3	Jul 12	Jun 8
C.V. %				28.2	58.0	13.2	23.6	--	--
LSD .05				1	NS	1	1	--	--

Hybrid	Planting Date	Weed Control	Seed Yield	Seed Test Weight	Seed Weight	Seed Oil Content
		%	lbs/ac	bu/ac	seed/lb	%
Hyola357	Spring	85	2,025	52.4	145,485	43.5
Hyola357	Fall	74	1,351	51.8	158,184	41.8
Hyola357	Fall	65	1,298	51.4	152,822	41.6
Hyola357	Fall	69	1,190	51.6	154,343	41.6
Minot	Fall	70	906	51.3	154,049	42.6
Minot	Fall	64	850	51.6	155,110	42.6
Minot	Spring	83	1,507	51.9	143,095	44.3
Minot	Fall	69	935	51.5	152,503	42.7
Minot	Fall	71	1,116	51.6	143,301	43.2
Mean		72	1,242	51.7	150,988	42.6
CV%		9.3	19.5	1.6	9.7	1.8
LSD .05		10	354	NS	NS	1.1

Planting Date: November 10, 1999 (Fall) April 4, 2000 (Spring)
Harvest Date: August 8, 2000
[1] First evaluation done approximately 21 days after emergence.
[2] Second evaluation done approximately 35 days after emergence.

2000 Mustard - Continuously Cropped No-till — **Hettinger**

Variety	Days to First Flower	Days to Last Flower	Days to Maturity	Plant Height	Lodg.	Yield 1997	Yield 1999	Yield 2000	Average Yield 2 Year	Average Yield 3 Year
Yellow				inches	0 - 9*			lbs/ac		
AC Pennant	50	82	104	34	3.0	2258	2240	2040	2140	2179
Tilney	51	82	105	36	2.5	1885	2178	1653	1916	1905
Viscount	54	83	105	35	3.0	1911	1974	1667	1820	1851
AC Base	51	82	104	36	3.0		2251	1827	2039	
Oriental										
AC Vulcan	58	84	104	44	2.0	1956	2365	2409	2387	2243
Forge	60	86	106	42	3.5	1538	2276	2060	2168	1958
Trial Mean	54	83	105	38	2.8	1953	2214	1922	--	--
C.V. %	0.5	0.5	0.9	4.0	28.3	10.5	10.2	6.2	--	--
LSD .05	1	1	1	2	NS	353	NS	182	--	--
LSD .01	1	1	NS	3	NS	484	NS	252	--	--

Planting Date: April 10, 2000 Harvest Date: August 1, 2000
Seeding Rate: Yellow = 12 lbs/ac, Oriental = 6 lbs/ac.
Previous crop: 1997 = Fallow, 1999 & 2000 = HRSW
NS = no statistical difference between varieties.
*Lodging: 0 = none, 9 = laying flat on ground.

Juncea (Oil Mustard) - No-till Recrop — **Hettinger**

Variety	Days to First Flower	Days to Last Flower	Days to Maturity	Plant Height	Lodg.	Yield
				inches	0 - 9*	lbs/ac
J90-4316	57	85	106	41	4	2000
PC98-45	58	84	105	41	2	1833
JM16	57	82	102	37	2	1800
PC98-44	58	83	102	38	2	1760
Q2 canola	63	86	109	39	2	2487
Trial Mean	59	84	105	39	2	1976
C.V. %	0.0	0.4	0.9	6.7	20.9	13.1
LSD .05	1	1	1	NS	1	383
LSD .01	1	1	2	NS	1	524

Planting Date: April 10, 2000 Harvest Date: August 1, 2000
Seeding Rate: 6 lbs/ac.
Previous crop: Field pea
NS = no statistical difference between varieties.
*Lodging: 0 = none, 9 = laying flat on ground.

2000 Crambe - Continuously Cropped No-till — **Hettinger**

Variety	Days to First Flower	Days to Matur	Plant Ht	Oil	Test Weight	Yield 1997	Yield 1998	Yield 2000	Avg. Yield 2 Year	Avg. Yield 3 Year
			in	%	lbs/bu	lbs/ac	lbs/ac	lbs/ac	lbs/ac	lbs/ac
Belann	63	100	44	30.2	25.2	2954	1876	1953	1914	2261
Meyer	60	98	43	30.3	23.8	2173	1325	1987	1656	1828
Carmen	60	98	42	28.4	23.0			1640		
Trial Mean	61	99	42	29.9	24.0	2572	1337	2038	--	--
C.V. %	1.1	1.1	4.3	7.7	4.1	10.6	15.7	12.7	--	--
LSD .05	1	1	NS	NS	1.4	382	347	NS	--	--
LSD .01	1	2	NS	NS	1.9	507	NS	NS	--	--

Planting Date: April 24, 2000 — Harvest Date: August 8, 2000
Seeding Rate: 20 lbs/ac.
Previous Crop: 1997 = Fallow, 1998 = Durum, 2000 = Field pea.
NS = no statistical difference between varieties.

2000 Safflower - Continuously Cropped No-till — **Hettinger**

Variety	Days to Flower	Plant Height	Test Weight	Oil	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 Year	Average Yield 3 Year
		inches	lbs/bu	%	pounds per acre	pounds per acre	pounds per acre	pounds per acre	pounds per acre
S-518	94	31	36.9	38.7	1860	1271	1847	1559	1659
Montola 2000	93	27	38.7	39.5	1700	1067	1640	1354	1469
S-541	95	31	38.1	41.3	1667	913	1393	1153	1324
Centennial	96	30	36.6	40.1	1580	787	1120	954	1162
Finch	95	31	41.5	36.8	1367	887	1100	994	1118
Montola 2001	96	29	37.4	38.4	1387	753	1167	960	1102
Montola 2003	95	28	38.7	38.0		1260	1553	1406	
Trial Mean	95	30	38.6	38.9	1567	1034	1493	--	--
C.V. %	0.8	5.0	1.4	1.2	17.8	19.4	13.4	--	--
LSD .05	1	2	0.8	0.6	400	287	286	--	--
LSD .01	1	3	1.1	0.9	NS	385	382	--	--

Planting Date: April 17, 2000 — Harvest Date: August 25, 2000
Seeding rate: 400,000 live seeds/acre.
Previous crop: 1998 = Durum, 1999 = HRSW, 2000 = Soybeans.
NS = no statistical difference between varieties.

Table 9. 2001 North Dakota Flax Variety Descriptions.

Variety[1]	Origin	Year Released	Relative Maturity[2]	Seed Color[3]	Plant Height	Wilt	Relative Yield
NorLin	Can.	1982	early	br.	med.	MS	good
AC-Watson	Can.	1996	early	br.	short	MR	v.good
CDC-Valour	Can.	1996	early	br.	short	MR	v.good
Linton	ND	1985	early	br.	med.	R	v.good
Prompt	SD	1988	early	br.	med.	MR	good
AC-Emerson	Can.	1994	mid.	br.	med.	VR	v.good
CDC-Normandy	Can.	1995	mid.	br.	short	MR	v.good
Cathay	ND	1998	mid	br.	med	MR	v. good
Pembina	ND	1998	mid	br.	med	MR	v. good
Neche	ND	1988	mid	br.	med.	R	good
Omega	ND	1989	mid	yel.	med.	MS	v.good
NorMan	Can.	1984	mid	br.	med.	MR	good
Rahab 94	SD	1994	mid	br.	med.	MR	good
CDC Arras	Can.	1999	mid.	br.	med.	MR	v.good
CDC Bethume	Can.	1999	mid./late	br.	med. tall	MR	v.good
AC Carnduff	Can.	1998	mid/late	br.	med. tall	MR	v.good
Flanders	Can.	1989	late	br.	med.	MS	good
Webster	SD	1998	late	br	tall	MR	v. good
McDuff	Can.	1993	late	br.	med.tall	MR	v.good
AC Linora	Can.	1993	late	br.	tall	R	v.good
McGregor	Can.	1980	late	br.	tall	R	v.good
Shelby	SD	2000	late	br	tall	MR	good

1 All varieties have resistance to prevalent races of rust; all have good oil yield and oil qulaity.
2 Varieties listed order of maturity.
3 br = brown, yel = yellow.

2000 Flax - Continuously Cropped No-till — **Hettinger**

Variety	Days to Flower	Plant Height	Test Weight	Grain Yield 1998	Grain Yield 1999	Grain Yield 2000	Average Yield 2 Year	Average Yield 3 Year
		inches	lbs/bu	bu/ac	bu/ac	bu/ac		
CDC Bethume	66	25	54.2	20.2	36.9	31.4	34.20	29.5
CDC Arras	64	24	53.6	22.3	35.8	28.4	32.1	28.8
CDC Carnduff	63	25	54.3	20.2	34.4	28.5	31.4	27.7
Webster	65	26	54.4	18.4	34.7	29.5	32.1	27.5
Pembina	65	25	54.0	19.7	35.7	26.6	31.2	27.3
Rahab 94	66	25	54.4	20.5	33.5	27.6	30.6	27.2
CDC Normandy	65	26	54.6	19.8	34.0	27.6	30.8	27.1
CDC Valour	63	25	54.1	19.8	34.0	27.0	30.5	26.9
AC Watson	65	25	53.4	17.8	33.3	27.6	30.4	26.2
Prompt	64	25	54.0	21.1	30.8	25.9	28.4	25.9
AC Emerson	65	24	54.2	20.0	31.4	24.3	27.8	25.2
AC Linora	66	25	54.3	17.6	30.1	27.5	28.8	25.1
Norlin	66	26	54.6	17.0	30.4	27.5	29.0	25.0
Cathay	66	26	53.9	19.5	30.4	24.1	27.2	24.7
Omega	69	25	54.6	19.0	30.4	23.9	27.2	24.4
Neche	65	26	54.8	17.3	27.3	27.5	27.4	24.0
Shelby	67	25	54.7			27.4		
Trial Mean	65	25	54.3	18.9	32.9	27.2	--	--
C.V. %	0.9	3.3	0.5	8.4	12.8	5.3	--	--
LSD .05	1	1	0.4	2.6	NS	2.0	--	--
LSD .01	1	2	0.5	3.5	NS	2.7	--	--

Planting Date: April 17, 2000
Harvest Date: August 8, 2000
Seeding rate: 32 lbs/Acre
Previous crop: 1998 & 99 = HRSW, 2000 = soybean.
NS = no statistical difference between varieties.

Brand	Hybrid	Type	Days to Mature	Test weight	Oil Content	Yield 1998	Yield 1999	Yield 2000	Avg. Yield 2 Year	Avg. Yield 3 Year
				lbs/bu	%			lbs/ac		
AgriPro	AP3430		130	31.3	38.2			1514		
Cargill	SF125NL	nusun	131	35.1	35.5			1710		
Croplan Gen.	CL345	nusun	128	32.5	42.5			1654		
Croplan Gen.	CL380	nusun	136	33.6	41.0		1560	2031	1796	
Croplan Gen.	CL385	nusun	136	32.4	41.9		1967	2540	2254	
Croplan Gen.	CL803		131	32.8	45.6	2396	906	1856	1381	1719
Interstate	4049		133	32.4	40.4			1668		
Interstate	6039		129	33.5	45.7	2506	1050	2031	1540	1862
Interstate	6111		125	33.8	42.5	2025	648	1696	1172	1456
Interstate	x74018		132	33.8	43.8			2401		
Kaystar	8300		128	31.1	46.1	2615	837	1898	1368	1783
Kaystar	9404		133	31.4	39.8			2317		
Legend Seed	LSF142N	nusun	131	32.5	41.2			2198		
Legend Seed	LSF122		131	32.7	45.0			1926		
Monsanto	DKF29-90		128	33.9	49.3			2205		
Monsanto	DKF31-01	nusun	134	33.7	37.8			2024		
Monsanto	DKF36-40	nusun	135	32.4	33.1			1605		
Monsanto	DK3868		131	33.6	48.0	3339	1784	2394	2089	2506
Monsanto	DK3875		137	33.3	45.2	3704	2088	3029	2558	2940
Monsanto	DK3900		138	32.2	44.0			2387		
Monsanto	Ex9910	nusun	131	32.4	37.3			2149		
Monsanto	Ex9915	nusun	132	33.0	38.2			1800		
Mycogen	8372		130	33.0	44.8			1842		
Mycogen	8377	nusun	131	32.6	36.2			1738		
Mycogen	8488		133	33.3	40.9			1891		
Mycogen	Cavalry		132	34.2	48.2			2345		

continued

2000 Sunflower - continued **Hettinger**

Brand	Hybrid	Type	Days to Mature	Test weight	Oil Content	Yield 1998	Yield 1999	Yield 2000	Avg. Yield 2 Year	Avg. Yield 3 Year
				lbs/bu	%			lbs/ac		
Pioneer	63A30		130	32.1	45.3			2317		
Pioneer	63A70		128	31.5	47.2		1606	1884	1745	
Pioneer	63A81		132	31.4	44.2	2457	1170	1696	1433	1774
Pioneer	63M80	nusun	132	32.6	43.2		1399	2191	1795	
Pioneer	63M91	nusun	131	32.8	42.0		1514	1835	1674	
Proseed	9103	nusun	133	30.5	40.0	2250	1032	1375	1204	1552
Proseed	9123	nusun	136	29.0	38.9		1084	1549	1316	
Proseed	92.5		127	33.4	47.1			2101		
Proseed	9612		136	32.9	32.0			1856		
Seeds 2000	Bronco	nusun	132	32.3	41.2		1749	2205	1977	
Seeds 2000	Maverick	nusun	132	31.2	36.7		941	1766	1354	
Seeds 2000	Mustang	nusun	130	32.5	37.6		975	2059	1517	
Triumph	765C	conf.	137	23.7	18.8			1075		
check	Hysun311		124	32.3	47.5		665	1263	964	
check	SF270		127	32.0	45.7	2469	1176	1961	1568	1869
check	P6451		131	30.7	45.3	2895	1101	2191	1646	2062
check	hyb 894		127	31.5	38.5	2992	1262	1800	1531	2018
Trial Mean			131	32.3	41.5	2399	1233	1950	--	--
C.V. %			1.7	2.2	5.9	15.0	20.3	14.0	--	--
LSD .05			4	1.2	4.0	500	349	442	--	--
LSD .01			5	1.5	5.3	660	461	587	--	--

Planting date: April 20, 2000
Harvest date: October 12, 2000
Seeding rate: 21,000 seeds/acre, thinned to 18,000 plants/acre.
Row spacing: 28"
Previous crop: 1998 = Summer fallow, 1999 & 2000 = HRSW.
Yields and oil content are adjusted to 10% moisture. Oil content has been adjusted for nusun types.
Notes: The 1999 crop sustained moderate hail damage.

Sunflower Date of Planting – Amidon, ND

Planting Date[1]	1999		2000		2 year average	
	Test weight	Yield	Test weight	Yield	Test weight	Yield
	lb/bu	lb/ac	lb/bu	lb/ac	lb/bu	lb/ac
1st	31.6	1206.6	26.1	1159.3	28.9	1183.0
2nd	--	--	27.1	1310.2	--	--
3rd	28.1	1765.0	27.0	1434.5	27.6	1599.8
4th	25.7	1507.7	25.9	1362.2	25.8	1435.0
5th	22.6	989.8	--	--	--	--
Mean	27.0	1367.3	26.5	1316.5		
CV%	5.6	13.6	1.9	11.3		
LSD .05	2.4	297.8	0.8	238.0		

1 Planting Date: 1st date = April 28, 1999 and April 26, 2000; 2nd date = May 10, 2000; 3rd date = May 23, 1999 and May 24, 2000; 4th date = June 4, 1999 and June 7, 2000; and 5th date = June 14, 1999.

Variety: Mycogen 8242NS

1999 Harvest: October 10 for 1st, 3rd, and 4th planting dates; October 28 for 5th planting date.
2000 Harvest: September 25 for 1st planting date; September 28 for 2nd, 3rd, and 4th planting dates.

2000 Chickpea - Continuously Cropped No-till — **Hettinger**

Variety	Days to First Flower	Days to Last Flower	Dis*	Plant Height	1000 Kernel wt.	Test Weight	Yield 1998	Yield 1999	Yield 2000	** 3 year Avg. Yield
			0-9	inches	grams	lbs/bu	lbs/ac	lbs/ac	lbs/ac	lbs/ac
Kabuli:										
Sanford	86	95	4.2	21	258	--	1607	1860	267	1722
Dwelley	85	93	6.5	18			1427	1533	0	1449
CDC Yuma	85	96	4.0	19	241	61.8		1773	587	
Evans	84	93	6.0	21				1620	0	
CDC Xena	86	96	5.2	16					0	
CA9783152C	89	93	4.0	19					0	
CA9783165C	84	93	4.8	19	232	--			187	
Small Kabuli:										
B-90	84	96	2.8	19	209	64.1		2380	1627	
CDC Chico	84	96	3.8	17	188	60.6		2307	787	
Green Kabuli:										
CDC Verano	83	96	4.5	14					0	
Black Kabuli:										
Black		No Emergence								
Desi:										
Myles	84	98	1.0	17	165	61.0	2047	2667	1860	2416
CDC Desiray	84	98	1.0	16	155	61.9			1553	
Spanish White:										
CA9783007W	--	--	9.0						0	
Trial Mean	85	95	5.1	18	194	62.0	1693	2026	1215	--
C.V. %	0.9	1.3	28.2	6.8	10.3	3.4	9.3	17.9	28.6	--
LSD .05	1	2	1.3	2	31	NS	246	531	531	--
LSD .01	2	2	1.7	2	43	NS	347	720	740	--

Planting Date: April 11, 2000
Harvest Date: August 25, 2000
Previous Crop: Field pea
**Ascochyta* Disease Rating: 0 = disease free, 9 = dead plants.
**3 year average yield (1997 - 1999). 2000 yields are not included.
Notes: Raptor herbicide severely delayed plant development.

2000 Lentils - Continuously Cropped No-till Hettinger

Variety	Days to First Flower	Days to Last Flower	Harvest Height	* Disease	1000 Kernel wt.	Test Weight	Yield 1998	Yield 1999	Yield 2000	Average Yield ** 2 year	Average Yield *** 3 year
			inches	0-9	grams	lbs/bu	lbs/ac	lbs/ac	lbs/ac		
CDC Richlea	74	98	11	3.5	40.4	59.6	2353	1160	680	1756	1618
Crimson	74	94	11	5.5	31.2	62.7	2560	1113	800	1836	1543
Brewer	73	98	9	5.5	45.9	58.9	2393	1133	473	1763	1528
Laird	76	95	11	7.2	47.3	--	1880	673	140	1276	1082
Mason	75	97	10	3.8	49.4	58.1	2667	1000	387	1834	
CDC Vantage	75	98	10	3.0	41.3	61.0		1248	800		
CDC Milestone	75	98	11	3.8	32.3	61.9		1220	740		
CDC Glamis	76	94	9	6.5	42.1	--		587	173		
Trial Mean	75	96	10	4.8	41.2	60.7	2375	1017	524	--	--
C.V. %	0.6	1.8	10.6	19.3	5.0	0.8	7.7	20.9	29.2	--	--
LSD .05	1	3	NS	1.4	3.0	0.7	269	311	225	--	--
LSD .01	1	NS	NS	1.9	4.1	1.1	366	422	307	--	--

Planting Date: April 11, 2000
Harvest Date: August 8, 2000
Seeding Rate: 550,000 live seed/acre.
Previous Crop: 1998 & 99 = HRSW, 2000 = Field pea.
*Disease rating (ascochyta): 0 = disease free, 9 = dead plants.
**2 year average yield (1998 and 1999).
***3 year average yield (1997 - 1999).
NS = no statistical difference between varieties.

2000 Pinto Beans - Continuously Cropped No-till **Hettinger**

Variety	Days to Bloom	Yield 1997	Yield 1999	Yield 2000	Average Yield 2 Year	Average Yield 3 Year
		lbs/ac				
Othello	56	1266	910	1575	1242	1250
Topaz	56	1255		1435	1345	
Maverick	57		712	1517	1114	
Winchester	56			1353		
Remington	58			1276		
Trial Mean	57	1335	761	1431	--	--
C.V. %	--	10.1	16.5	17.0	--	--
LSD .05	--	NS	184	NS	--	--

2000 Navy Beans - Continuously Cropped No-till **Hettinger**

Variety	Days to Bloom	Yield 1997	Yield 1999	Yield 2000	Average Yield 2 Year	Average Yield 3 Year
		lbs/ac				
Norstar	59	1278	945	1338	1142	1187
Mayflower	61	817	916	996	956	910
Vista	64			1338		
Navigator	62			1322		
Arthur	60			1167		
Great Northern						
Weihing	57			1524		
Trial Mean	60	976	896	1281	--	--
C.V. %	3.6	17.8	21.6	13.2	--	--
LSD .05	4	291	NS	307	--	--

Planting Date: May 15, 2000 Harvest Date: September 8, 2000
Previous crop: 1997 = Fallow, 1999 & 2000 = HRSW
NS = no statistical difference between varieties.

2000 Soybeans - No-till	Hettinger

Variety	Days to Bloom	Test Weight	Yield
		lbs/bu	bu/ac
Barns	62	56.3	30.4
Traill	62	56.5	26.4
Jim	62	56.9	23.9
Daksoy	62	56.9	23.7
Trial Mean	62	56.6	26.1
C.V. %	1.8	0.7	6.7
LSD .05	NS	NS	2.7
LSD .01	NS	NS	3.8

Planting Date: May 10, 2000

Harvest Date: September 14, 2000
Seeding rate: 150,000 live seeds/acre
Previous crop: HRSW

2000 Field Pea Variety Trial - Continuously Cropped No-till — **Hettinger**

Variety	Seed Type	Days to First Flower	Days to Last Flower	Days to Matur.	Plant Ht. at Harvest	Lodg.	Test Weight	1000 Kernel Weight	Seeds per Pound	Yield 1998	Yield 1999	Yield 2000	Average Yield 2 year	Average Yield 3 year
	*				inches	0-9**	lbs/bu	grams		bu/ac				
Atomic	G	61	73	94	21	2	65.3	249	1222	58.9	65.7	47.0	56.4	57.2
Profi	Y	60	73	91	18	5	63.1	193	1574	64.4	65.7	33.6	49.6	54.6
Highlight	Y	62	75	90	12	8	64.2	152	1999	55.1	70.4	37.3	53.8	54.3
Majoret	G	62	72	93	21	4	64.6	193	1579	60.6	55.1	35.1	45.1	50.3
Carneval	Y	63	75	94	21	3	64.2	151	2011	55.4	56.2	30.2	43.2	47.3
Grande	Y	64	74	96	14	7	63.5	186	1639	49.0	60.3	27.1	43.7	45.5
Toledo	G	57	72	94	26	2	63.5	236	1287		59.9	36.8	48.4	
Trapper	Y	66	75	101	11	8	63.7	77	3962		32.2	12.0	22.1	
CDC Mozart	Y	61	76	91	11	8	64.7	194	1566			50.0		
Swing	Y	57	72	92	23	3	64.4	212	1436			44.0		
Integra	Y	57	72	94	27	2	63.8	237	1282			38.8		
CDC Verdi	G	64	76	98	15	6	64.4	169	1800			34.0		
CDC Handel	Y	62	75	93	10	8	64.2	154	1980			32.7		
Trial Mean		61	74	94	18	5	64.1	185	1795	58.1	58.8	35.3	--	--
C.V. %		0.9	0.7	1.4	14.2	20.5	0.7	4.3	4.1	9.0	10.1	11.4	--	--
LSD .05		1	1	2	4	1	0.6	11	105	7.6	8.6	5.7	--	--
LSD .01		1	1	2	5	2	0.8	15	139	10.2	11.6	7.7	--	--

*Seed Type: Y = Yellow, G = Green.
Planting Date: April 20, 2000
Seeding Rate: 250,000 live seeds/acre

**Lodging: 0 = None, 9 = Laying flat on ground.
Harvest Date: August 1, 2000
Previous Crop: 1998 & 99 = HRSW, 2000 = Field Pea

Field Pea - Recrop — **Dickinson, ND**

Variety	Type	Days to Flower	Flower Duration	Seeds per Pound	Test Weight	Grain Yield 1998	Grain Yield 2000	Returns	2 Year Average
			days		lbs/bu	-----bu/ac-----		$/ac	bu/ac
Atomic	G	57	11	1,456	64.9	55.9	37.0	62.97	46.5
CDC Handel	Y	57	12	2,285	65.4	--	42.1	71.51	--
CDC Mozart	Y	57	11	2,024	66.4	--	52.5	89.26	--
CDC Verdi	G	57	10	2,114	65.4	--	39.2	66.70	--
Carneval	Y	57	13	2,124	65.5	--	40.9	69.51	--
Grande	Y	57	14	1,910	65.9	45.8	46.0	78.26	45.9
Highlight	Y	57	11	2,270	66.6	54.4	46.5	79.03	50.5
Majoret	G	57	11	1,808	66.4	--	43.9	74.59	--
Profi	Y	56	12	1,496	65.4	--	39.8	67.62	--
Trapper	Y	59	26	3,302	62.0	--	44.0	74.79	--
Trial Mean	--	57	13	2,079	65.4	52.8	43.2	73.43	--
C.V. %	--	0.7	4.8	9.1	1.1	8.4	8.6	8.6	--
LSD .05	--	1	1	276	1.1	6.6	5.4	9.15	--

Planting Date: April 25
Harvest Date: July 31
Type: Y = Yellow, G = Green
Returns calculated using market value of $1.70/bu

	Plant Stand		Nodule Size		Nodule Amount		Plant Height	Yield	Protein	Test Weight	Kernel Weight	Grade
	First[1]	Second[2]	First	Second	First	Second						
	----plants/m²----		---------0-9----------		----------0-9----------		inches	bu/ac	%	lb/bu	seed/lb	
Treatment												
235AMN(B)	137	139	1	1	1	1	18	36.1	24.0	67.1	1,824	1.6
CHECK 0/0	145	142	4	4	2	2	17	35.7	23.1	66.4	1,807	1.6
GRANULAR	149	148	6	4	5	5	17	41.0	25.7	66.6	1,762	1.3
GRANULAR+40MAP(B)	145	138	5	5	4	5	18	41.4	24.6	66.8	1,802	1.6
GRANULAR+40MAP(W)	94	92	5	5	5	6	17	41.0	25.6	66.3	1,754	1.3
GRANULAR+48TSP(B)	146	133	6	4	4	5	18	38.1	24.1	66.5	1,790	1.3
LIQUID	153	144	5	5	4	5	18	36.7	25.2	66.8	1,803	1.6
LIQUID+40MAP(B)	145	138	5	3	3	3	17	40.5	25.9	66.9	1,791	1.0
LIQUID+40MAP(W)	105	111	4	4	4	5	17	40.0	25.8	66.3	1,745	1.3
LIQUID+48TSP(B)	150	144	6	5	3	4	18	40.3	25.9	67.3	1,743	2.3
PEAT	143	135	6	5	5	5	18	38.8	25.0	66.9	1,819	1.6
PEAT+13AMN(W)	110	109	5	4	4	5	17	35.5	25.3	66.6	1,809	1.0
PEAT+20MAP(W)	128	125	5	4	4	5	18	42.0	25.1	67.4	1,776	1.6
PEAT+40MAP(B)	147	133	5	5	4	4	18	39.3	26.6	66.6	1,773	1.6
PEAT+40MAP(W)	100	91	5	4	5	4	20	38.7	25.2	66.9	1,758	1.6
PEAT+48TSP(B)	149	144	6	4	5	5	19	39.7	24.8	66.8	1,781	1.0
PEAT+48TSP(W)	132	125	6	3	5	4	18	37.9	24.8	66.6	1,757	1.3
Mean	134	129	5	4	4	4	18	38.9	25.1	66.8	1,782	1
CV	8.8	10.2	21.1	28.7	23.3	23.0	8.8	9.7	3.6	0.9	2.4	39.3
LSD .05	17	19	1	2	1	1	NS	NS	1.5	NS	NS	NS

Planting Date: April 11
Harvest Date: July 28
[1] First count made approximately 21 days after planting (DAP).
[2] Second count made approximately 42 DAP.
B = broadcast
W = with seed

2000 Corn - Continuously Cropped No-till — **Hettinger**

Brand	Hybrid	Relative matur.	Days to tassel	Silage Harvest moist.	Silage 1999	Silage 2000	Test weight	Grain Yield 1999	Grain Yield 2000
		days		%	-----Tons/ac*-----		lbs/bu	-----bu/ac**-----	
Asgrow	RX489RR	100	90	70		4.09	49.9		68.3
Dekalb	DK405	90	84	60	5.72	4.65	54.2	76.9	72.4
Dekalb	DKC36-71	86	85	68		3.63	53.5		69.5
Dekalb	DKC39-45	89	87	60		5.00	54.9		70.6
Dekalb	DKC46-26	96	86	69		4.77	56.4		86.2
Garst	8966	87	82	49		5.39	54.8		65.5
Garst	8972IT	87	82	46		6.45	56.5		68.1
Garst	N8956	87	82	56		4.25	55.5		54.9
Kaystar	KX-405	90	88	66	5.28	4.39	54.7	65.1	64.0
IS/Payco	155	80	79	52		4.23	56.2		57.4
IS/Payco	3X417	91	89	70	4.64	4.39	53.7	62.2	63.6
IS/Payco	4X309	85	82	54	5.60	4.61	55.0	55.5	54.2
Trial Mean				85	5.24	4.65	54.6	61.1	66.2
C.V. %				1.8	13.8	18.3	1.6	12.7	12.6
LSD .05				2	1.22	1.22	1.3	13.0	12.0
LSD .01				3	1.65	1.64	1.7	17.6	16.1

Planting date: May 3, 2000
Seeding rate: 21,000 seeds/acre, thinned to 18,000 plants/acre.
Row spacing: 28"
Harvest date: Silage - August 30, 2000
Grain - September 28, 2000
Previous crop: 1999 = Canola, 2000 = Soybean.
*Silage yields are adjusted to 0% moisture.
**Grain yields are adjusted to 13.5% moisture.

2000 Hybrid Corn - Recrop **Dickinson, ND**

Brand	Hybrid	Relative Maturity	Silage Yield: Harvest Moisture	Silage Yield: 70% Moisture	Silage Yield: Dry Matter Basis	Test Weight	Grain Yield
		days	%	tons/ac	tons/ac	lbs/bu*	bu/ac*
Garst	8966	87	76	12.1	3.6	--	--
Garst	8972IT	87	78	10.4	3.1	--	--
Top Farm	5754	72	71	11.2	3.3	59.7	44.4
Dekalb	DK 405	90	77	10.1	3.0	60.4	59.5
Dekalb	DKC 39-45	89	81	9.1	2.7	55.4	56.8
Dekalb	DKC 46-26	96	77	9.4	2.8	62.1	56.5
Northrup King	N 17-C5	85	76	10.9	3.3	60.8	58.3
Northrup King	NX 1107	75	76	10.7	3.2	58.6	39.3
Northrup King	NX 2127	85	75	10.2	3.1	57.1	52.4
IS/Payco	155	83	--	--	--	59.2	49.5
Asgrow	Rx489RR	100	75	9.8	2.9	52.7	42.1
IS/Payco	4x309	85	78	9.8	2.9	61.4	43.9
Trial Mean			76	10.2	3.1	58.9	50.7
C.V. %			3.4	16.8	16.8	3.0	16.5
LSD .05			4	NS	NS	2.6	NS

Planting Date: May 10
Harvest Date: August 14 (silage); September 28 (grain)
*Grain yield and test weight are adjusted to 12%moisture; yield calculated from middle 2 rows of each 4-row plot. Plot dimension was 10 x 150 ft.

2000 Proso Millet Continuously Cropped No-till	Hettinger

Variety	Days to Head	Plant Height	Lodg.	Test Weight	Grain Yield 1997	Grain Yield 1999	Grain Yield 2000	Average Yield 2 year	Average Yield 3 year
		inches	0-9*	lbs/bu	lbs/ac				
Manta**	74	34	0.2	53.2	2840	2720	1938	2329	2499
Siberian**	74	32	0.2	53.4	3040	2660	1689	2174	2463
Earlybird	77	39	3.5	52.7	1493	2260	1327	1794	1693
Rise	75	37	4.7	52.9	1353	2067	1280	1674	1567
Sunup	75	36	3.2	53.3	1360	2040	1207	1624	1536
Huntsman	80	40	2.5	51.4	1467	2107	951	1529	1508
Sunrise	79	38	2.8	53.0	1380	1953	1147	1550	1493
Dawn	74	36	5.5	53.2	1147	1713	1333	1523	1398
Snowbird	76	39	4.0	52.1	1400	1753	860	1306	1338
Minsum	76	36	3.7	50.3	1273	1873	773	1323	1306
Cerise	72	38	4.0	53.3	953	1560	660	1110	1058
Turghai	72	34	1.5	53.8		1147	647	897	
Trial mean	75	37	2.9	52.8	1610	2006	1131	--	--
C.V. %	2.2	6.5	36.3	1.7	19.1	15.8	10.5	--	--
LSD .05	2	3	1.5	1.3	444	455	171	--	--
LSD .01	3	5	2.1	1.7	598	611	231	--	--

*Lodging: 0 = no lodging, 9 = lying flat on ground.
**Foxtail millets
Planting Date: May 10, 2000
Harvest Date: September 14, 2000
Seeding rate: 25 lbs/Ac.
Previous crop: 1997 = Fallow, 1999 = HRSW, 2000 = Soybean
Notes: moderate European corn borer damage to proso types.

2000 Grain Sorghum - No-till **Hettinger**

Hybrid	Days to Head	Test Weight	Grain Yield
		lbs/bu	bu/ac
Pioneer 8925	69	55.6	67.8
NK251	73	54.3	45.6
Agripro 2140	74	51.8	44.3
Dekalb DK28E	76	47.2	34.6
Agripro 2020	72	51.7	33.5
Dekalb DK18		no emergence	
Trial Mean	73	52.1	45.2
C.V. %	1.7	1.7	22.5
LSD .05	2	1.6	18.8
LSD .01	3	2.3	27.0

Planting Date: June 2, 2000
Harvest Date: October 10, 2000
Seeding rate: 120,000 live seeds/A.
Previous Crop: HRSW

2000 Buckwheat - No-till **Hettinger**

	Days to Bloom	Lodg.	Yield
		0-9*	lbs/ac
Manor	38	6.5	389
AC Manisoba	37	5.0	371
Koban	36	5.2	348
AC Springfield	37	3.7	330
Mancan	38	5.5	262
Koto	37	2.2	210
Trial Mean	37	4.7	323
C.V. %	0.7	31.4	35.0
LSD .05	1	2.3	NS
LSD .01	1	3.1	NS

Planting Date: June 2, 2000
Harvest Date: September 19, 2000
Previous crop: Buckwheat
*Lodging: 0 = none, 9 = laying flat on ground.
NS = no statistical difference between varieties.
Notes: Trial sustained moderate hail damage.

Alfalfa Plant Density Trial — **Dickinson, ND**

	Hay Yield													
	DM Basis													
Seeding rate/ac	1996	1997		1998			1999				2000			5 yr
	Total	1st	2nd	Total	1st	2nd	Total	1st	2nd	Total	1st	2nd	Total	Ave
Hand 1 plant/sqft	0.3	1.1	0.6	1.7	0.9	1.2	2.1	1.2	0.8	2.0	0.6	0.8	1.4	1.5
Hand 2 plant/sqft	0.4	1.5	0.8	2.3	1.3	1.5	2.8	1.5	0.9	2.4	0.8	0.7	1.5	1.9
Hand 3 plant/sqft	0.5	1.5	0.8	2.3	1.0	1.2	2.2	1.7	1.0	2.7	0.7	0.9	1.6	1.9
Hand 4 plant/sqft	0.5	1.4	0.9	2.3	1.1	1.4	2.5	1.4	1.0	2.4	0.7	1.0	1.7	1.9
1 lbs PLS/ac	0.7	1.2	0.9	2.1	1.0	1.2	2.2	1.4	0.6	2.0	0.7	0.8	1.5	1.7
2 lbs PLS/ac	0.8	1.2	0.9	2.1	1.1	1.3	2.4	1.6	0.9	2.5	0.6	0.8	1.4	1.8
4 lbs PLS/ac	0.8	1.5	0.9	1.4	0.9	1.3	2.2	1.8	0.7	2.5	0.6	0.9	1.5	1.7
8 lbs PLS/ac	0.8	1.5	1.1	2.6	1.0	1.4	2.4	1.8	1.0	2.8	0.5	1.0	1.5	2.0
16 lbs PLS/ac	0.8	1.6	1.0	2.6	1.0	1.6	2.6	1.8	0.7	2.5	0.6	0.8	1.4	2.0
32 lbs PLS/ac	0.7	1.6	1.1	2.7	0.8	1.5	2.3	1.7	0.8	2.5	0.5	0.9	1.4	1.9
Mean	0.6	1.4	0.9	2.2	1.0	1.4	2.4	1.6	0.8	2.4	0.6	0.9	1.5	1.8
C.V. %	13.9	10.0	12.6	--	18.8	15.3	--	14.5	33.1	--	35.9	17.4	--	--
LSD .05	0.1	0.2	0.2	--	NS	NS	--	NS	NS	--	NS	NS	--	--

1st cut = June 8, corresponds to late bud
2nd cut = July 24, corresponds to 50% bloom
PLS = Pure Live Seed
NS = no statistical difference

Forage Legume Adaptation Trial 1-2000 **Dickinson, ND**

		Mechanical Harvest			Hand Harvest
Entry	Height	Moisture	Ton/ac	Ton12	Ton/ac
	in	%	DM		
Eski Sanfoin	16	76	0.6	0.7	1.3
George Black Medic	11	72	0.4	0.4	2.9
Ladak Alfalfa	25	72	1.5	1.7	3.6
Norcen Birdsfoot Trefoil	12	74	0.8	0.9	1.3
Sweetclover	23	80	1.3	1.5	2.9
Mean	19	75	0.9	1.0	2.4
CV%	13.2	3.0	32.3	32.3	29.2
LSD .05	5	4	0.6	0.6	3.2

Forage Legume Adaptation Trial 1-2000 **Dickinson, ND**

		Hand Harvest					
		Moisture			Yield		
		Weeds			Weeds		
Entry	Height	Legume	Grass	Broadleaf	Legume	Grass	Broadleaf
	in	%--	%--	%--	Ton/ac		
Austrian Winter Pea	28	74	93	80	4.0	--	1.7
Eski Sanfoin	16	74	63	72	1.3	--	0.1
George Black Medic	11	63	--	67	2.9	--	1.6
Ladak Alfalfa	25	73	--	85	3.6	--	0.0
Norcen Birdsfoot Trefoil	12	78	65	77	1.3	--	0.3
Sweetclover	23	78	67	75	2.9	--	0.0
Mean	19	73	64	76	2.7	--	0.6
CV%	13.2	2.3	--	5.0	29.3	--	34.6
LSD .05	5	3	--	--	NS	--	NS

NS=no statistical difference

Forage Legume Adaptation Trial II-2000	Dickinson, ND

Entry	Height	Moisture	Yield	Plant count	Emergence Date
	in	-----%-----	Ton/ac	plants/ac	
Ac Greenfix Chickling vetch	17	70	1.7	140,290	Apr 30
Alfa-Graze alfalfa	12	58	1.3	547,670	Apr 28
Alsike clover	--	71	1.2	787,781	Apr 29
Austrian winter pea	29	75	2.0	375,006	Apr 29
Big Bee berseem clover	9	71	1.3	482,921	Apr 28
Bolta balansa clover	11	68	1.2	528,785	Apr 28
Cossack kura clover	--	50	0.8	383,099	Apr 29
Crown vetch	--	51	0.8	91,728	May 7
Eski sanfoin	12	60	1.1	105,217	Apr 29
Fenugreek	10	65	1.4	604,326	Apr 28
Foxtail dalea	--	--	--	8,094	May 11
George black medic	5	57	1.2	129,498	Apr 29
Hairy vetch	--	70	1.4	323,746	May 2
Hay & Graze alfalfa	11	53	1.3	348,027	Apr 28
Indianhead Lentil	11	66	1.7	442,453	Apr 29
Ladak alfalfa	--	57	1.2	326,444	Apr 29
Ladino clover	--	62	1.2	385,797	Apr 29
Monarch cicer milkvetch	--	45	0.9	75,541	May 5
Namoi woolypod vetch	20	70	0.8	288,673	Apr 30
Nitro persian clover	9	71	1.4	493,712	Apr 29
Norcen birdsfoot trefoil	--	56	0.9	118,707	May 3
Trial Mean	12	62	1.3	335,886	Apr 30
%CV	12.4	10.7	17.6	51.2	0.0

Forage Legume Adaptation Trial II-2000 **Dickinson, ND**

Entry	Height	Moisture	Yield	Plant count	Emergence Date
	in	-----%-----	Ton/ac	plants/ac	
Parabinga barrel medic	4	54	1.7	218,528	Apr 29
Purple vetch	16	65	2.0	631,304	Apr 30
Rangelander alfalfa	11	61	1.2	285,975	Apr 29
Red Gold red clover	--	65	1.2	593,534	Apr 29
Roughpea	--	67	1.2	515,295	May 6
Sa 10344	1	--	--	78,239	Apr 29
Santiago burr medic	5	58	1.6	563,857	Apr 29
Sava snail medic	10	67	1.6	99,822	Apr 29
Spreador 3 alfalfa	14	59	1.2	563,857	Apr 29
Tibbee crimson clover	13	65	1.5	731,126	Apr 28
Travois alfalfa	12	62	1.2	186,154	Apr 29
White blossom sweetclover	11	62	1.0	110,613	Apr 29
Yellow sweetclover	10	66	1.2	229,320	Apr 29
Yellowhead alfalfa	12	50	0.9	97,124	May 1
Zulu arrowleaf clover	--	64	1.2	199,643	Apr 29
Trial Mean	12	62	1.3	335,886	Apr 30
%CV	12.4	10.7	17.6	51.2	0.0

Arvika Pea Fertility Trial - Recrop **Dickinson, ND**

Variety	Treatment lb of N/ac	DM Basis CP % 1998	1999	2000	Mean	DM Basis ADF % 1998	1999	2000	Mean
Arvika	0	16.6	15.2	14.0	15.3	38	31	30	33
Arvika	20	16.4	15.3	14.4	15.4	41	36	30	36
Arvika	40	16.2	15.0	12.2	14.5	37	36	31	35
Arvika	60	17.8	13.9	16.6	16.1	37	37	31	35
Trial Mean		16.8	14.8	14.3	--	39	35	30	--
C.V. %		16.2	12.3	15.3	--	13.1	12.7	6.8	--
LSD .05		NS	NS	NS	--	NS	NS	NS	--

Arvika Pea Fertility Trial - Recrop **Dickinson, ND**

Variety	Treatment lb of N/ac	DM Basis NDF % 1998	1999	2000	Mean	DM Basis RFV % 1998	1999	2000	Mean
Arvika	0	44	40	42	42	124	152	151	142
Arvika	20	51	42	42	45	107	139	148	131
Arvika	40	47	46	42	45	120	122	145	129
Arvika	60	46	45	44	45	124	125	136	128
Trial Mean		47	43	42	--	118	134	145	
C.V. %		12.9	10.6	9.5	--	17.3	16.8	11.3	
LSD .05		NS	NS	NS	--	NS	NS	NS	

CP = crude protein
ADF = acid detergent fiber
NDF = neutral detergent fiber
RFV = relative feed value

Arvika Pea Fertility Trial - Recrop — **Dickinson, ND**

Variety	Treatment lb of N/ac	Yield 12% 1998	1999	2000	Mean	Yield DM Basis 1998	1999	2000	Mean
Arvika	0	3.2	2.3	2.0	2.5	2.8	2.0	1.8	2.2
Arvika	20	3.0	2.5	2.1	2.5	2.6	2.2	1.9	2.2
Arvika	40	2.9	2.8	2.2	2.6	2.6	2.4	1.9	2.3
Arvika	60	2.8	2.7	2.2	2.6	2.5	2.4	2.0	2.3
Trial Mean		3.0	2.6	2.1	--	2.6	2.2	1.9	--
C.V. %		6.5	12.2	11.5	--	6.5	12.2	11.5	--
LSD .05		NS	NS	NS	--	NS	NS	NS	--

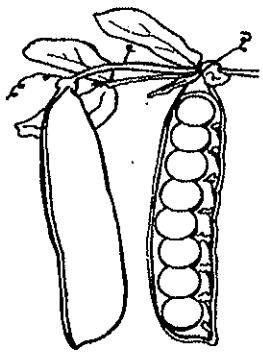
Arvika Pea Fertility Trial - Recrop — **Dickinson, ND**

Variety	Treatment lb of N/ac	Harvest Moisture % 1998	1999	2000	Mean	Vine length inches 1998	1999	2000	Mean
Arvika	0	73	74	77	75	56	44	15	38
Arvika	20	72	74	77	74	57	45	16	39
Arvika	40	75	73	76	75	57	45	15	39
Arvika	60	76	72	77	75	59	44	16	40
Trial Mean		74	73	77	--	57	45	15	--
C.V. %		2.4	2.0	0.9	--	5.4	4.1	6.9	--
LSD .05		NS	NS	NS	--	NS	NS	NS	--

Arvika Pea Fertility Trial - Recrop **Dickinson, ND**

Treatment	Yield		DM Basis			
lbs of N/ac	12%	DM Basis	CP	ADF	NDF	RFV
	Tons/ac		%			
0	2.0	1.8	14.0	30	42	151
20	2.1	1.9	14.4	30	42	148
40	2.2	1.9	12.2	31	42	145
60	2.2	2.0	16.6	31	44	136
Trial Mean	2.1	1.9	14.3	31	42	145
C.V. %	11.5	11.5	15.3	6.8	9.5	11.3
LSD .05	NS	NS	NS	NS	NS	NS

Seeding date: April 11
Harvest date: July 10
CP=crude protein; ADF=acid detergent fiber; NDF=neutral detergent fiber, RFV= relative feed value
NS=no statistical difference



2000 Winter Spring Intercrop Trial-Recrop **Dickinson, ND**

Variety	Yield			Height	
	Dry Matter	12% Moisture	Harvest Moisture	Winter Cereal	Spring Cereal
	tons/ac		%	inches	
2700 Spring Triticale	1.5	1.7	67	--	39
Dacold Winter Rye / 2700 Triticale	1.6	1.8	67	32	33
Dumont Oat	1.5	1.7	68	--	33
Frostat Winter Triticale	1.1	1.3	68	36	--
Haybet Barley	1.5	1.7	65	--	26
Roughrider Winter Wheat	0.6	0.7	65	17	--
Roughrider wheat / 2700 Triticale	1.3	1.4	68	17	36
Roughrider wheat / Dumont oat	1.1	1.3	66	14	28
Roughrider wheat / Haybet barley	1.2	1.4	67	15	24
Experimental Forage Oat	1.6	1.8	71	--	27
Trial Mean	1.3	1.5	67	19	31
C.V. %	10.0	10.0	3.7	13.2	11.6
LSD .05	0.2	0.2	NS	3.9	5.3

Seeding date: May 25
Harvest date: July 21
NS=no statistical difference

Table 1. Emergence counts on May 22 for various seed treatments, August and Perry Kirschmann Farm, Regent, ND, 2000.

Treatment	Emergence count
	no./ft^2
Fumigated	25.8
Charter MAX	21.8
Charter PB	23.6
DB Green L	23.0
DB Green L + RR	23.8
Dividend XL	24.5
RTU Vitavax + Thiram	22.1
Raxil MD	23.2
Raxil + Lindane	22.9
Raxil XT	24.6
Check	23.8
Mean	23.7
CV%	11.5
LSD $_{.05}$	NS

Table 2. Initial root and plant evaluations of Trenton hard red spring wheat with various seed treatments, August and Perry Kirschmann Farm, Regent, ND, 2000.

Treatment	Development Stage	Length[1]	Tillers	Subcrown internode rating[2]	Seminal roots	Crown roots
	Haun	inches	no./plant		no./plant	no./plant
Fumigated	6.7	16.2	2.5	0.2	4.7	11.0
Charter MAX	6.2	15.0	1.8	0.1	5.0	7.9
Charter PB	6.3	15.0	1.9	0.2	4.7	7.8
DB Green L	6.3	14.2	2.1	0.4	4.6	7.8
DB Green L + RR	6.1	14.2	1.9	0.4	4.4	8.4
Dividend XL	6.1	13.7	1.9	0.3	4.6	8.2
RTU Vitavax + Thiram	6.3	14.6	2.0	0.3	4.6	8.5
Raxil MD	6.2	14.1	2.0	0.4	4.9	8.9
Raxil MD + Lindane	6.1	14.6	1.8	0.3	4.9	6.9
Raxil XT	6.3	14.5	2.2	0.2	4.8	9.2
Check	6.2	14.4	1.3	0.9	4.0	6.8
Mean	6.3	14.8	2.0	0.3	4.8	8.2
CV%	2.4	5.5	17.0	105.0	6.4	12.8
LSD $_{.05}$	0.2	1.2	0.5	0.4	0.4	1.5

1 Length measured from the crown to the tip of the last fully extended leaf of the plant.

2 Subcrown internode rating, 0-4. 0 = no infection, 1 = less than 25% of the internode infected, 2 = 25-50% of the internode infected, 3 = 51-75% of internode infected, multiple lesions, and 4 = 75-100% of internode infected, lesions coalesced.

Table 3. Grain yield, test weight, height, and head density at harvest of Trenton hard red spring wheat grown under various seed treatments, August and Perry Kirschmann Farm, Regent, ND, 2000.

Treatment[1]	Head density	Height	Yield[2]	Test weight[2]	Protein[2]
	no./yd^2	inches	bu/a	lb/bu	%
Fumigated	387.8	34.6	44.8	59.3	16.6
Charter MAX	308.2	33.9	39.6	59.2	15.8
Charter PB	306.6	33.7	36.9	58.8	16.2
DB Green L	295.6	34.0	37.7	58.5	15.9
DB Green L + RR	317.4	33.6	39.0	59.0	15.8
Dividend XL	311.4	33.7	39.4	58.6	16.1
RTU Vitavax + Thiram	288.1	33.2	38.0	58.7	15.6
Raxil MD	280.6	32.7	37.5	59.4	15.5
Raxil + Lindane	299.1	33.4	37.5	59.0	15.9
Raxil XT	305.2	34.0	39.2	57.8	16.0
Check	259.5	33.4	37.0	59.9	15.6
Mean	299.7	33.6	38.3	58.8	15.9
CV%	9.6	2.8	6.6	2.8	2.7
LSD $_{.05}$	33.1	NS	2.9	NS	0.5

1

Product Name	Fungicide
Charter MAX	Triticonazole + Metalaxyl
Charter PB	Triticonazole + Thiram
DB Green L	Maneb + Lindane (insecticide)
DB Green L + RR	Maneb + Imazalil + Lindane (insecticide)
Dividend XL	Difenoconazole + Mefenoxam
RTU Vitavax + Thiram	Carboxin + Thiram
Raxil MD	Tebuconazole + Metalaxyl
Raxil + Lindane	Tebuconazole + Lindane (insecticide)
Raxil XT	Tebuconazole + Metalaxyl (dry formulation)
Check	No Seed Treatment
Fumigated	No Seed Treatment/Soil Fumigated with Methyl Bromide

2 All yields, test weights and proteins adjusted to 12% moisture basis.

Propagule count (propagules per gram of soil/ppg): Pythium 390 ppg (High); Fusarium 1680 ppg (Very High).

2000 Evaluation of POST Applied Fungicides on Chickpeas — **Hettinger**

Treatment	Product Rate per Acre		Disease*		1000 Seed Weight	Test Weight	Yield
	1st Application	2nd Application	23 DAT	31 DAT			
	June 28	July 10	0-9	0-9	grams	lbs/bu	lbs/acre
6-28 Foliar	4 gallons	0	2.2	4.8	228	59.4	473
BASF 500	8.2 oz	0	2.2	3.0	376	61.7	1753
BASF 500	5.5 oz	5.5 oz	1.2	1.8	376	61.8	1753
Bravo Zn	3 pt	3 pt	1.8	3.0	369	61.4	1553
Dithane DF	2 lbs	2 lbs	1.8	3.0	328	61.4	1273
Flint	2 oz	2 oz	1.2	2.8	390	61.9	1807
Quadris	9.6 oz	0	2.0	2.8	364	61.7	1687
Quadris	6.8 oz	6.8 oz	2.5	2.5	392	61.7	1767
Walabi	1.7 pt	1.7 pt	1.5	2.2	394	61.5	1727
Untreated	0	0	2.5	4.0	309	53.3	1073
Trial Mean			1.9	3.0	353	60.7	1487
C.V. %			44.6	36.5	12.6	8.6	26.4
LSD 5%			NS	1.6	64	NS	568
LSD 1%			NS	NS	87	NS	765

* Disease rating (23 and 31 Days After Treatment): 0 = disease free, 9 = dead plants.
Variety = Sanford
Planting Date: April 28, 2000
Harvest Date: August 25, 2000
NS = no statistical differences between treatments.
Fungicide phytotoxicity was not observed.

2000 Evaluation of POST Applied Fungicides on Field Peas — **Hettinger**

Treatment	Product Rate per Acre 1st Application	2nd Application	Disease* 23 DAT	1000 Seed Weight	Test Weight	Yield
	June 28	July 10	0-9	grams	lbs/bu	lbs/acre
BASF 500	8.2 oz	0	4.2	221	65.0	2193
BASF 500	5.5 oz	5.5 oz	3.5	209	65.0	2041
Bravo Zn	3 pt	3 pt	3.8	226	64.9	2360
Dithane DF	2 lbs	2 lbs	3.0	212	65.6	2053
Flint	2 oz	2 oz	2.8	208	64.6	2220
Quadris	9.6 oz	0	3.8	220	64.5	2273
Quadris	6.8 oz	6.8 oz	4.0	213	65.3	2073
Untreated	0	0	4.8	218	64.8	2247
Trial Mean			3.7	216	65.0	2183
C.V. %			23.9	3.3	0.9	11.8
LSD 5%			NS	5.2	NS	NS

* Disease rating (23 Days After Treatment): 0 = disease free, 9 = dead plants.
Variety = Majoret
Planting Date: April 28, 2000
Harvest Date: August 1, 2000
NS = no statistical differences between treatments.
Fungicide phytotoxicity was not observed.

2000 Evaluation of POST Applied Fungicides on Lentils — **Hettinger**

Treatment	Product Rate per Acre		Disease*		1000 Seed Weight	Test Weight	Yield
	1st Application	2nd Application	23 DAT	31 DAT			
	June 28	July 10	0-9	0-9	grams	lbs/bu	lbs/acre
BASF 500	8.2 oz	0	3.0	5.3	48.8	60.7	1458
BASF 500	5.5 oz	5.5 oz	2.0	5.0	47.6	61.0	1778
Bravo Zn	3 pt	3 pt	2.7	5.7	46.7	60.9	1511
Dithane DF	2 lbs	2 lbs	3.0	5.0	47.0	61.1	1476
Flint	2 oz	2 oz	3.7	6.0	45.2	60.6	1236
Quadris	9.6 oz	0	3.7	6.3	46.3	60.4	1325
Quadris	6.8 oz	6.8 oz	4.7	7.0	45.7	60.3	1262
Untreated	0	0	3.7	7.0	43.3	60.3	1093
Trial Mean			3.4	6.0	46.3	60.7	1392
C.V. %			24.7	19.9	4.0	0.7	12.9
LSD 5%			1.4	NS	NS	NS	309
LSD 1%			NS	NS	NS	NS	424

* Disease rating (23 and 31 Days After Treatment): 0 = disease free, 9 = dead plants.
Variety = CDC Richlea
Planting Date: April 28, 2000
Harvest Date: August 8, 2000
NS = no statistical differences between treatments.
Fungicide phytotoxicity was not observed.

Wheat-Pea Tillage Trial, Wheat 2000 — **Dickinson, ND**

	Soil Moisture	Plant Count	Tiller Count		Heading Date	Spikes	Residue
			Tillers	Growth Stage			
	feet	p/2m^2	no/plant	leaves		no/m^2	%
Tillage							
Conventional	1.7	347	1.7	7.7	Jun 20	218	14
Reduced	2.0	366	1.9	7.9	Jun 20	270	23
None	2.4	471	2.1	7.4	Jun 23	346	90
F-test	*[1]	*	*	*	NS	*	*
Rotation							
Wheat/Pea	2.0	413	1.9	7.8	Jun 20	270	35
Wheat/Wheat	2.1	376	1.9	7.6	Jun 21	286	49
F-test	NS	NS	NS	*	*	NS	*
Trial Mean	2	394.4	1.9	7.7	Jun 21	278	42
C.V.%	16.6	11.8	10.4	3.0	--	8.9	30

[1] * = significant at the P<.05 level; NS = not significant

Wheat-Pea Tillage Trial, Wheat 2000 **Dickinson, ND**

	Plant Height	Yield	Test Weight	Protein	Seeds per Pound	Returns
	inches	bu/ac	lbs/bu	%		$/ac
Tillage						
Conventional	28	33.5	59.9	15.7	11,502	100.22
Reduced	31	38.2	59.0	15.5	12,173	110.87
None	33	48.3	59.4	13.5	12,103	112.98
F-test	*[1]	*	NS	*	NS	NS
Rotation						
Wheat/Pea	31	45.5	58.9	15.0	11,623	124.50
Wheat/Wheat	30	34.5	60.0	14.8	12,229	91.55
F-test	NS	*	NS	NS	*	NS
Trial Mean	30	40.0	59.5	14.9	11,926	108.03
C.V.%	7.2	15.8	2.0	4.6	4.9	18.0

[1] * = significant at the P<.05 level; NS = not significant

Wheat-Pea Tillage Trial, Wheat 2000 **Dickinson, ND**

	Soil Nitrogen			Soil Phosphorus		Organic Matter
	Pre-plant	Post-harvest		Pre-plant	Post-harvest	Post-harvest
	0-2ft	0-2ft	2-4ft			
	----------lbs/acre----------			----------ppm----------		------%------
Tillage						
Conventional	19	19	16	13.9	11.3	2.3
Reduced	22	19	9	14.5	11.8	2.2
None	31	20	7	14.9	12.1	2.6
F-test	NS	NS	NS	NS	NS	NS
Rotation						
Wheat/Pea	27	21	9	13.9	11.5	2.4
Wheat/Wheat	21	18	12	14.9	11.9	2.4
F-test	*[1]	NS	NS	*	NS	NS
Trial Mean	24	20	11	14.4	11.7	2.4
C.V.%	12.6	54.2	117.7	22.5	21.5	14.8

[1] * = significant at the P<.05 level; NS = not significant

Wheat-Pea Tillage Trial, Pea 2000 — **Dickinson, ND**

	Yield	Test Weight	Seeds per Pound	Returns	Soil Moisture	Plant Count	Heading Date	Residue
	lbs/ac	lbs/bu		$/ac	feet	p/2m^2		%
Tillage								
Conventional	2,035	67.1	2,073	57.67	1.7	102	Jul 1	19
Reduced	2,611	67.1	2,086	73.99	2.3	117	Jul 1	18
None	3,472	66.5	2,108	98.37	2.5	106	Jul 2	95
Trial Mean	2,706	66.9	2,089	76.68	2.2	108	Jul 1	44
C.V. %	11.5	1.8	3.1	11.5	15.6	10.7	0.0	20.2
LSD .05	539	NS	NS	15.27	0.6	NS	NS	15

NS = not significant
Returns calculated using market value of $1.70/bu

Wheat-Pea Tillage Trial, Pea 2000 — **Dickinson, ND**

	Soil Nitrogen		Soil Phosphorus	Organic Matter
	Post-harvest		Post-harvest	Post-harvest
	0-2ft	2-4ft		
	-------lbs/acre-------		-----ppm-----	---------%---------
Tillage				
Conventional	15	6	10.5	2.4
Reduced	19	7	15.5	2.5
None	15	9	17.0	2.6
Trial Mean	16	7	14.3	2.5
C.V. %	24.7	27.3	31.1	15.0
LSD .05	NS	NS	NS	NS

NS = not significant

Wheat-Canola Tillage Trial, Wheat 2000 **Dickinson, ND**

	Soil Moisture	Plant Count	Tiller Count		Heading Date	Spikes	Residue
			Tillers	Growth Stage			
	feet	p/2m^2	no/plant	leaves		no/m^2	%
Tillage							
Conventional	1.5	355	1.7	7.6	Jun 20	236	13
Reduced	1.9	360	2.0	7.7	Jun 20	278	12
None	2.4	504	1.9	7.5	Jun 22	308	71
F-test	*[1]	*	NS	NS	*	*	*
Rotation							
Wheat/Canola	1.9	416	1.9	7.6	Jun 21	285	23
Wheat/Wheat	1.9	397	1.8	7.6	Jun 21	262	40
F-test	NS	NS	NS	NS	NS	NS	*
Trial Mean	1.9	406	1.9	7.6	Jun 21	274	32
CV %	17.9	14.9	24.2	5.0	--	12.5	40.3

[1] * = significant at the P<.05 level; NS = not significant

Wheat-Canola Tillage Trial, Wheat 2000 **Dickinson, ND**

	Plant Height	Yield	Test Weight	Protein	Seeds per Pound	Returns
	inches	bu/ac	lbs/bu	%		$/ac
Tillage						
Conventional	26.2	24.3	60.7	17.3	12,014	74.84
Reduced	27.9	31.6	60.1	15.3	11,848	84.47
None	30.3	35.5	60.2	13.3	12,320	81.94
F-test	*[1]	*	NS	*	NS	NS
Rotation						
Wheat/Canola	28.1	31.9	60.4	15.6	11,938	87.95
Wheat/Wheat	28.2	29.1	60.2	14.9	12,183	72.87
F-test	NS	NS	NS	NS	NS	*
Trial Mean	28.2	30.49	60.3	15.3	12,061	80.41
CV %	5.7	15.9	2.0	6.2	4.77	18.65

[1] * = significant at the P<.05 level; NS = not significant

Wheat-Canola Tillage Trial, Wheat 2000 — **Dickinson, ND**

	Soil Nitrogen			Soil Phosphorus		Organic Matter
	Pre-plant	--Post-harvest--		Pre-plant	Post-harvest	Post-harvest
	0-2ft	0-2ft	2-4ft			
	----------lb/acre----------			----------ppm----------		------%-----
Tillage						
Conventional	16	30	15	11.3	9.9	2.1
Reduced	31	28	12	15.8	14.0	2.4
None	31	15	6	11.9	10.9	2.2
F-test	*[1]	NS	*	*	NS	*
Rotation						
Wheat/Canola	25	26	11	12.8	10.6	2.3
Wheat/Wheat	27	23	11	13.1	12.5	2.2
F-test	NS	NS	NS	NS	NS	NS
Trial Mean	26	24	11	13.0	11.6	2.2
C.V. %	17.5	68.2	44.2	10.7	26.2	6.5

[1] * = significant at the P<.05 level; NS = not significant

Wheat-Canola Tillage Trial, Canola 2000 — **Dickinson, ND**

	Yield	Test Weight	Seeds per Pound	Soil Moisture	Plant Count	Heading Date	Residue
	lbs/ac	lbs/bu		feet	p/2m^2		%
Tillage							
Conventional	391	47.5	94,000	1.4	218	Jun 28	10
Reduced	638	47.3	97,828	2.3	274	Jul 1	25
None	860	47.6	101,210	2.3	303	Jul 1	96
Trial Mean	630	47.5	97,679	2.0	265	Jun 30	44
C.V. %	23.8	2.1	30.5	21.0	36.6	0.0	22.5
LSD .05	NS	NS	NS	0.7	NS	NS	17

NS = not significant

Wheat-Canola Tillage Trial, Canola 2000 — **Dickinson, ND**

	Soil Nitrogen		Soil Phosphorus	Organic Matter
	Post-harvest		Post-harvest	Post-harvest
	0-2ft	2-4ft		
	-------lbs/acre-------		-----ppm-----	---------%--------
Tillage				
Conventional	15	13	12.3	2.0
Reduced	19	7	13.0	2.3
None	14	8	12.3	2.4
Trial Mean	16	9	12.5	2.2
C.V. %	30.6	61.0	27.4	12.2
LSD .05	NS	NS	NS	NS

NS = not significant

VARITAL TOLERANCE TO FAR-GO HERBICIDE AT HETTINGER (Eriksmoen)
Stand reduction: + = susceptible, ? = questionable, 0 = tolerant

Variety	5/22/00	6/9/99	5/26/98	6/18/97	6/20/96	6/9/95
Butte 86	0	0	0	0	0	0
2375	0	0	0	0	0	0
2398	0	0	0	0	0	0
Grandin	0	0	0	0	0	0
Keene	0	0	+	0	+	0
Ernest	+	0	?	0	+	0
Russ	0	0	?	0	0	0
Oxen	0	0	0	0	0	0
Gunner	0	0	0	0	+	
Reeder	0	0	0	0	0	
Parshall	0	0	0	0	0	
HJ98	0	0	0	0		
Ingot	0	0	0			
Ivan	+	0	+			
Ember	0	0	0			
Norpro	0	0				
Scholar	0	0				
Dandy	0	0				
McKenzie	+	0				
Mercury	0	0				
Aurora	+	0				
Alsen	0	0				
Conan	0					
AC Vista	0					
GC Impervo	0					
Prodigy	0					
AC Barrie		0	?	0	+	+
Kulm		0	0	0	+	+
2371		0	0	0	0	0
Argent HWSW		0	0	0	0	0
Amidon		0	+	+	+	+
Trenton		0	0	0	0	0
Hammer		0	+	0	+	+
Lars		0	0	0	0	0
Sharp		0	0	0	0	0
Verde		0	0	0	0	0
Nora		0	0	0	0	
Forge		0	0	0	+	
AC Cadillac		0	0	0		
Sharpshooter		0	0	0		
Hager		0	+	0		
McVey		0				
Majestic		0				
AC Eatonia			0	0	0	+
McNeal			0	0	0	0
BacUp			0	0		
AC Crystal			+			

Planting date: 4/4/00, 4/13/99, 4/8/98, 4/29/97, 4/18/96, 4/7/95
Date of Application: 3/27/00, 4/12/99, 4/3/98, 4/3/97, 4/19/96, 4/24/9
Rate of Application: 1997-00 = 3 pts/A, 1995/6 = 2 pts/A

HRSW VARIETY TOLERANCE TO AVENGE HERBICIDE AT HETTINGER (Eriksmoen)

Injury: + = susceptible, 1 = moderate tolerance, 0 = tolerant

HRSW	1993	1994	1995	1996	1997	1998	1999	2000
Keene	0	1	0	1	1	1	0	0
Butte 86	0	1	+	1	1	1	1	1
Grandin	+	+	+	+	+	1	1	1
2375	0	1	1	1	0	1	0	0
2398	0	1	1	+	0	0	0	0
Ernest	0	1	0	1	0	0	0	1
Russ		+	1	1	1	1	0	0
Oxen			0	1	0	1	0	1
Gunner				+	+	+	+	+
Reeder				+	+	+	1	+
Parshall				+	+	+	0	0
HJ98					0	0	0	0
Ingot						1	0	0
Ivan						0	0	0
Ember						1	0	0
Scholar							0	0
Norpro							0	0
Dandy							0	0
McKenzie							0	0
Mercury							0	0
Aurora							0	0
Alsen							1	+
Conan								0
AC Vista								0
GC Impervo								0
Prodigy								0
2371	0	1	1	+	0	1	0	
Sharp	0	1	1	1	0	1	0	
Kulm	0	1	1	1	0	+	+	
Amidon	0	+	0	1	1	0	1	
Trenton	+	+	+	+	+	+	1	
Hamer		1	0	1	0	1	0	
Lars		1	1	1	0	1	0	
Verde		+	+	+	+	+	+	
AC Barrie			0	1	0	1	0	
Argent HWSW			+	+	+	1	0	
Forge				1	1	1	0	
Nora				+	+	+	+	
AC Cadillac					0	1	0	
Sharpshooter					0	1	0	
Hager					0	1	0	
McVey							0	
Majestic							0	
McNeal	0	+	1	1	1	0		
AC Eatonia		+	0	1	0	1		

Date of Application: 5/13/93, 5/20/94, 5/29/95, 6/11/96, 6/2/97, 5/25/98, 5/20/99, 5/15/00

Rate of Application: 4 pts/A, (1999=3.5 pts/A)

DURUM VARIETY TOLERANCE TO AVENGE HERBICIDE AT HETTINGER (Eriksmoen)

Injury: + = susceptible, 1 = moderate tolerance, 0 = tolerant

Durum	1993	1994	1995	1996	1997	1998	1999	2000
Rugby	0	1	0	1	0	1	0	0
Ben	0	1	0	1	0	1	0	0
Monroe	0	1	0	1	0	1	0	0
Renville	1	+	1	+	1	1	0	1
Plenty	0	1	1	1	0	1	0	0
Munich	0	1	1	1	0	1	1	0
Belzer	+	+	+	+	+	+	+	+
Maier	0	1	0	1	0	1	0	0
Mountrail		+	+	1	1	+	0	+
Lebsock		+	1	+	+	+	0	+
AC Melita			0	1	0	1	0	0
Plaza			1	1	1	1	0	0
Dressler				1	1	1	0	0
Kari				+		+	1	+
Vic	+	+	+	+	+	+	1	
Lloyd	0		0	1	1	1	0	
Ward	0	1	1	1	0	1		
Medora	0	1	1	1	+	1		
Sceptre	0	1	1	1	1	1		
Laker	1	+	+	+	+	+		
Regold	1	+	+	+	1	+		
Voss	0	1	+	+	0	1		

Date of Application: 5/13/93, 5/20/94, 5/29/95, 6/11/96, 6/2/97, 5/25/98, 5/20/99, 5/15/00

Rate of Application: 4 pts/A (1999=3.5 pts/A)

Wild Oat and Foxtail Control in Wheat at Hettinger. (Eriksmoen) 2375 hard red spring wheat was seeded on May 5. The treatment area was applied with Starane plus Buctril at 10 ounces plus 1 pint per acre, respectively, on June 2 to control broadleaf weeds. Treatments were applied to 4 1/2 leaf wheat and to 3 leaf foxtails and 3 1/2 leaf wild oats on June 7 with 88F, 31% RH, clear sky and 6 mph wind. Treatments were applied with a tractor mounted CO_2 propelled plot sprayer delivering 17 gpa at 40 psi through 8001 flat fan nozzles to a 5 foot wide area the length of 10 by 28 ft plots. The experiment was a randomized complete block design with four replications. The foxtail population was 22/ft^2 and the wild oat population was 7 plants/ft^2. Evaluations were on June 20 and July 4 for crop injury and on July 4 and August 2 for weed control. The trial was harvested on August 9.

Treatment	Product Rate	6/20	July 4			Aug. 2		8/9
		Wht	Wht	Fxtl	Wioa	Fxtl	Wioa	Yield
	oz/ac	----------			%	----------		bu/ac
Untreated	0	0	0	0	0	0	0	18.6
Discover+DSV	4+13	0	0	99	99	89	100	26.3
Discover+Bronate+DSV	4+16+13	4	5	95	99	86	100	20.9
Discover+Harm.GT+MCPE+DSV	4+0.5+8+13	0	0	98	96	80	100	25.9
Puma	6.4	0	0	99	99	94	100	24.2
Puma+Bronate	6.4+16	3	1	94	93	92	81	19.7
Puma+Harm.GT+MCPE	6.4+0.5+8	0	0	99	98	91	99	24.2
Achieve+SC*+AMS*	7.1+0.5%+1lb	0	1	94	99	89	100	25.4
Achieve+Bronate+SC+AMS	7.1+16+0.5%+1lb	3	5	89	99	89	100	23.9
Achieve+Harm.GT+MCPE+SC+AMS	7.1+0.5+8+0.5%+1lb	0	0	94	98	88	100	22.9
Everest+NIS*	0.4+0.25%	11	8	94	96	92	100	22.1
Everest+Bronate+NIS	0.4+16+0.25%	8	11	95	97	95	100	20.1
Everest+Harm.GT+MCPE+NIS	0.4+0.5+8+0.25%	22	19	95	98	91	99	19.4
Assert+NIS	16+0.25%	1	2	0	97	0	95	17.6
Assert+Bronate+NIS	16+16+0.25%	0	1	0	96	0	95	21.9
Assert+Harm.GT+MCPE+NIS	16+0.5+8+0.25%	3	1	0	99	0	100	21.7
C.V. %		109	166	6	4	6	4	12.3
LSD 5%		5	8	6	5	6	5	3.9
# of reps		4	4	4	4	4	4	4

*SC = Super Charge, AMS = ammonium sulfate, NIS = Class Preference

Summary

Everest treatments caused significant crop injury. The addition of Bronate tended to cause crop injury and reduced yields. Hot temperatures during treatment application probably contributed to this injury. Season long wild oat control was excellent on all herbicide treatments except for the Puma + Bronate treatment which had significantly lower control than the other herbicide treatments. Season long foxtail control was good on all herbicide treatments except for the Discover + Harmony GT + MCPE + DSV treatment and the Assert treatments. Significant yield reductions tended to be associated with treatments causing crop injury.

2000 Control of Smooth Bromegrass with Oasis and Roundup Ultra at Hettinger. (Eriksmoen)
Treatments were applied to 1 foot tall smooth bromegrass that was in the early boot stage on June 9 with 74F, 66% RH, partly sunny sky and 9 mph wind. Treatments were applied with a tractor mounted CO_2 propelled plot sprayer delivering 17 gpa at 40 psi through 8001 flat fan nozzles to a 10 foot wide area the length of 15 by 30 ft plots. The experiment was a randomized complete block design with three replications. Evaluations were on August 8 (60 DAT), September 6 (89 DAT) and on October 6 (119 DAT) for smooth bromegrass control.

Treatment	Rate	8/8	9/6	10/6
	lbs ai/ac	- % Control -		
1. Untreated	0	0	0	0
2. Oasis + MSO* + AMS	0.125&0.25+1qt+17lbs	15	50	33
3. Oasis + MSO + AMS	0.188&0.376+1qt+17lbs	40	68	57
4. Roundup Ultra + AMS	1.0qt+17lbs	58	75	75
5. Roundup Ultra + AMS	2.0qt+17lbs	85	90	93
6. Oasis+R'up Ult.+MSO+AMS	0.125&0.25+1.0qt+1qt+17lbs	85	91	93
7. Oasis+R'up Ult.+MSO+AMS	0.125&0.25+2.0qt+1qt+17lbs	96	99	98
8. Oasis+R'up Ult.+MSO+AMS	0.188&0.376+1.0qt+1qt+17lbs	82	92	92
9. Oasis+R'up Ult.+MSO+AMS	0.188&0.376+2.0qt+1qt+17lbs	99	99	99
C.V. %		11.3	11.8	21.5
LSD 5%		12	15	26
# of reps		3	3	3

*MSO = Scoil, AMS = ammonium sulfate

Summary
The Oasis treatments alone (trts 2 and 3) and the low rate of Roundup Ultra alone (trt 4) provided significantly lower bromegrass control than when applied in combination. The 2 quart rate of Roundup Ultra alone (trt 5) provided bromegrass control equal to the Oasis + Roundup Ultra treatment combinations. The lower rate of Oasis + Roundup Ultra (trt 6) provided bromegrass control equal to the higher rate combinations.

2000 Long Term Weed Management Trial, Wheat — Dickinson, ND

Treatment	Yield	Test Weight
	bu/ac	lbs/bu
Conventional Till	60.9	62.4
No-Till	57.3	64.1
Sustainable	53.5	62.4
Trial Mean	57.2	63.0
C.V. %	9.7	1.0
LSD .05	NS	1.4

NS = not significant

2000 Long Term Weed Management Trial, Corn — Dickinson, ND

Treatment	Harvest Moisture	Silage Yield		Plants per Acre
		Dry Matter Basis	70% Moisture	
	%	tons/ac	tons/ac	
Conventional Till	74	2.1	6.8	32,234
No-Till	77	2.2	7.5	33,686
Sustainable	73	0.5	1.6	23,813
Trial Mean	75	1.6	5.3	29,911
C.V. %	3.7	46.9	46.9	12.4
LSD .05	NS	NS	NS	NS

NS = not significant

Weed Control in Canola at Hettinger

Eric Eriksmoen

Treflan EC was applied and incorporated into the soil on March 27. The trial was seeded on April 4 and emerged on April 24. Moderate flea beetle feeding on seedlings was evident and the trial was sprayed with 8 ounces per acre Asana XL on May 16. Herbicide treatments were applied to 2 - 3 inch canola and to 4 leaf wild oats, 2 leaf foxtail, 2 inch kochia, 4 inch tansy mustard, 2 inch mallow and one inch Russian thistle on May 22 with 63 deg. F, 42% RH, clear sky and 6 mph wind. A second Roundup Ultra split application was applied to pre-bolting canola on June 2 with 62 deg. F, 52% RH, clear sky and 9 mph wind. Treatments were applied with a tractor mounted CO2 propelled plot sprayer delivering 17 gpa at 40 psi through 8001 flat fan nozzles to 5 foot wide by 20 foot long plots. The experiment was a randomized complete block design with four replications. Evaluations for crop injury and weed control were on June 12. The trial was harvested on July 31.

Summary and Discussion

Table 1 shows results of weeds controlled and table 2 shows agronomic results. Crop injury and disease problems were not observed. Treflan treatments tended to have good control of grass and broadleaf weeds with the exception of tansy mustard. Control of mallow was inconsistent. The additional Assure II application was not beneficial due to a lack of volunteer grains and good foxtail and wild oat control provided by the Treflan treatment. Roundup Ultra treatments provided excellent all around weed control. Roundup Ultra split applications did not enhance weed control or crop yields. Liberty and Raptor treatments also provided excellent grass and broadleaf weed control, although Raptor tended to be weaker on kochia. Crop yields were very good and significant differences were observed between varieties.

Conclusions

Good weed control and good genetics are paramount to achieving high canola yields. Weed control can be achieved with several different schemes including tillage, herbicide use, the use of herbicide tolerant varieties and a combination of these. It does not appear to matter which form of weed control is used if the end result is excellent weed control, although the economics of achieving this need to be considered. On the other hand, the genetic seed package plays an extremely important role in what we are trying to accomplish - yields. An emphasis on genetics resulting in high yields should therefor be of primary concern.

Table 1. 2000 Weed Control in Canola — **Hettinger**

Treatment	Rate	Variety	Crop Injury	Grass*	Kochia	Tansy Mustard	Mallow	Russian Thistle	Yield
	oz prod/ac		%	---------- % Weed Control ----------					lbs/ac
Treflan	24	Hudson	0	78	91	35	95	97	1773
Treflan + Assure II	24 + 9	Hudson	0	100	92	45	85	97	1856
Treflan	24	Hyola 401	0	100	90	58	79	97	2273
Treflan + Assure II	24 + 9	Hyola 401	0	100	91	45	92	91	2260
Roundup Ultra	16	LG3295	0	100	98	100	99	100	1727
Roundup Ultra	16	Hyola 357	0	100	100	100	99	100	2213
Roundup Ultra	16	Minot RR	0	100	100	100	100	100	1724
Roundup Ultra	16 + 16	LG3295	0	100	100	100	100	100	1727
Roundup Ultra	16 + 16	Hyola 357	0	100	100	100	100	100	2305
Roundup Ultra	16 + 16	Minot RR	0	100	100	100	100	100	1967
Liberty	34	Phoenix	0	100	100	100	100	100	1860
Liberty	34	INV2373	0	100	98	100	99	100	2080
Raptor	4	45A71	0	100	89	100	99	100	1820
Raptor	4	46A76	0	100	89	100	99	100	2213
Trial Mean			0	98	96	84	96	99	1986
C.V. %			--	12.2	3.7	26.9	8.9	2.6	13.9
LSD .05			--	NS	5	32	12	4	393
LSD .01			--	NS	7	43	NS	5	526

*Grassy weeds = foxtails and wild oats.

Table 2. 2000 Weed Control in Canola - Agronomics **Hettinger**

Treatment	Rate	Variety	Days to First Flower	Days to Last Flower	Plant Ht	Lodg	Kernel Weight	Oil	Test Weight	Yield
	oz prod/ac				in	0-9*	grams	%	lbs/bu	lbs/ac
Treflan	24	Hudson	64	89	28	2.2	2.9	41.4	51.4	1773
Treflan + Assure II	24 + 9	Hudson	64	89	30	2.0	2.9	41.7	51.7	1856
Treflan	24	Hyola 401	60	87	28	1.8	3.7	42.3	52.6	2273
Treflan + Assure II	24 + 9	Hyola 401	60	87	28	1.8	3.8	41.8	52.4	2260
Roundup Ultra	16	LG3295	66	90	27	3.2	3.4	41.2	52.0	1727
Roundup Ultra	16	Hyola 357	62	87	27	2.0	3.3	42.5	51.5	2213
Roundup Ultra	16	Minot RR	66	90	28	2.2	3.3	43.2	51.8	1724
Roundup Ultra	16 + 16	LG3295	66	89	29	3.5	3.3	41.3	52.0	1727
Roundup Ultra	16 + 16	Hyola 357	62	87	28	1.8	3.4	42.8	51.7	2305
Roundup Ultra	16 + 16	Minot RR	66	89	29	2.0	3.4	43.1	51.9	1967
Liberty	34	Phoenix	66	90	32	2.5	2.9	44.6	52.0	1860
Liberty	34	INV2373	67	90	35	2.5	3.3	43.9	52.9	2080
Raptor	4	45A71	66	89	28	3.8	3.2	42.2	51.1	1820
Raptor	4	46A76	68	91	35	3.0	3.2	44.1	51.0	2213
Trial Mean			65	89	30	2.4	3.3	42.6	51.9	1986
C.V. %			0.6	0.6	5.1	31.8	3.7	1.4	1.0	13.9
LSD .05			1	1	2	1.1	0.2	0.9	0.7	393
LSD .01			1	1	3	1.5	0.2	1.2	1.0	526

*Lodging: 0 = none, 9 = laying flat on ground.

Granular Nitrogen Fertilization Techniques in No-till

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Hettinger Research Extension Center

Many no-till farmers struggle with nitrogen fertilizer management in their small grain crops. Granular nitrogen sources are typically broadcast on the surface, applied with the seed during the planting process or incorporated into the soil prior to planting.

Surface applications of N fertilizers can be accomplished quickly and conveniently. The application depends on rainfall for incorporation into the root zone. A lack of timely rainfall can result in N loss due to volatilization. Some farmers over-apply, to compensate for these losses. A 1/4 to 1/2 inch rainfall will dissolve a pellet and safely leach the nitrogen into the soil sub-surface. Additional rainfall is required to leach the nitrogen into the root zone. The amount of rainfall needed to accomplish this is dependant on soil type and residue cover.

Nitrogen fertilization with the seed during planting is an efficient method, however, only small amounts can safely be applied to avoid seed mortality. The amount that can safely be applied with the seed is dependant on several factors including soil type, the soil moisture, the type of fertilizer used, row spacing, type of opener, crop species and other factors. Additional information is available in Extension Bulletin EB-62, Fertilizer Application with Small Grain Seed at Planting.

Banding N fertilizers in small grains is typically a slow process requiring an additional pass through the field prior to planting. The no-till grain drill is typically the piece of equipment utilized in this process, which makes it an expensive operation. The benefits of this method include the ability to place all of the N fertilizer down at one time and to place it directly into the root zone.

The objectives of this study were to observe differences in yield and grain quality characteristics of hard red spring wheat grown under various techniques of granular N fertilizer application methods in a no-till system.

Trials were grown in a randomized complete block design with four replications at Scranton (Bowman Co.), Regent (Hettinger Co.), New Leipzig (Grant Co.) and at Selfridge (Sioux Co.). Residual N was determined at each location and either 100 or 200 pounds per acre of 46-0-0 (Urea) was utilized, depending on level of residual N. Residual N levels were 46, 168, 122 and 47 pounds per acre at Scranton, Regent, New Leipzig and at Selfridge, respectively, with 200 pounds per acre of urea being utilized in the Scranton and Selfridge studies and 100 pounds per acre of urea being utilized in the other two sites. Fifty pounds per acre of 11-52-0 was applied with the seed at all locations and all treatments. The trials were planted with the spring wheat variety 2375 at a seeding rate of 1.1 million live seeds per acre with a coulter disc opener into soil that had been in winter wheat the previous year. Moderate hail damage and moderate foliar and head diseases caused reduced yields at New Leipzig. Results from each location are shown on the following page.

Test weight tended to not be significantly affected by fertilization technique. Grain protein tended to vary depending on fertilization technique with no added N having the lowest, followed by surface applied N, N applied with the seed and with banded N having the highest grain protein. As would be expected, there was no statistical differences for grain protein at Regent and New Leipzig where residual N levels were high. The highest grain yields tended to be associated with banded N, followed by surface applied N and finally, N applied with the seed where seed mortality resulting in thin stands was evident.

Scranton

Fertilization Technique	Test Weight	Grain Protein	Grain Yield
(200 lbs/ac Urea)	lbs/bu	%	bu/ac
No N Fertilizer	63.2	10.5	56.4
Surface applied N	63.2	12.1	68.3
N with Seed	61.4	13.5	49.9
Banded N	63.1	13.0	69.6
C.V. %	0.4	3.1	6.8
LSD .05	0.4	0.7	8.1
LSD .01	0.7	1.1	11.9

Planting Date: April 11, 2000
Harvest Date: August 9, 2000
Residual N = 46 lbs/acre
Applied N = 200 lbs/acre 46-0-0 (Urea)

Regent

Fertilization Technique	Test Weight	Grain Protein	Grain Yield
(100 lbs/ac Urea)	lbs/bu	%	bu/ac
No N Fertilizer	60.1	13.9	43.7
Surface applied N	58.3	14.3	43.7
N with Seed	60.3	14.7	44.0
Banded N	60.9	14.9	44.2
C.V. %	3.8	3.7	4.9
LSD .05	NS	NS	NS

Planting Date: April 12, 2000
Harvest Date: August 3, 2000
Residual N = 168 lbs/acre
Applied N = 100 lbs/acre 46-0-0 (Urea)

New Leipzig

Fertilization Technique	Test Weight	Grain Protein	Grain Yield
(100 lbs/ac Urea)	lbs/bu	%	bu/ac
No N Fertilizer	57.9	12.2	26.8
Surface applied N	60.6	12.8	32.7
N with Seed	60.2	13.3	31.4
Banded N	60.5	13.4	35.3
C.V. %	2.0	4.0	4.3
LSD .05	NS	NS	2.6
LSD .01	NS	NS	3.9

Planting Date: April 12, 2000
Harvest Date: August 3, 2000
Residual N = 122 lbs/acre
Applied N = 100 lbs/acre 46-0-0 (Urea)

Selfridge

Fertilization Technique	Test Weight	Grain Protein	Grain Yield
(200 lbs/ac Urea)	lbs/bu	%	bu/ac
No N Fertilizer	61.8	13.6	43.6
Surface applied N	61.8	14.3	46.7
N with Seed	61.0	15.1	42.9
Banded N	61.5	15.2	46.4
C.V. %	1.1	4.3	8.3
LSD .05	NS	1.0	NS

Planting Date: April 13, 2000
Harvest Date: August 10, 2000
Residual N = 47 lbs/acre
Applied N = 200 lbs/acre 46-0-0 (Urea)

2000 Chloride Trial — **Dickinson, ND**

	Days to Head	Height	Grain			Chloride Level	
			Yield	TW	Weight	Leaf	Grain
		--in--	--bu/ac--	--lbs/bu--	--kernels/lb--	----------%----------	
Chloride (lb/ac)							
0	60	28	35.1	61.1	12,779	0.0640	0.0317
40	58	27	35.0	61.1	12,072	0.5673	0.0570
Wheat Variety							
2375	58	26	36.1	60.9	12,055	0.2950	0.0350
Amidon	61	32	39.2	60.8	12,368	0.3375	0.0450
Butte86	57	29	35.9	61.8	11,737	0.2700	0.0425
Domain	58	30	34.2	60.4	14,140	0.3700	0.0500
Grandin	58	27	31.5	61.4	11,296	0.2925	0.0375
Guard	56	24	32.2	61.4	13,477	0.2500	0.0450
Hamer	60	25	30.9	61.5	11,383	0.3450	0.0400
Kulm	56	28	34.3	62.6	12,260	0.3800	0.0625
Marshall	61	24	35.2	61.2	12,953	0.4125	0.0525
Monroe	59	28	30.2	60.2	11,251	0.3625	0.0400
Renville	62	29	37.7	61.3	12,072	0.2750	0.0475
Russ	57	28	38.4	61.3	12,123	0.3025	0.0325
Teal	58	29	34.4	59.1	14,261	0.2025	0.0425
Trenton	60	30	37.3	61.4	12,741	0.3200	0.0550
Verde	60	27	37.8	61.9	12,270	0.3200	0.0375
Mean	59	28	35.0	61.1	12,426	0.3457	0.0443
CV (%)	2.5	6.0	7.5	0.8	8.8	15.8	22.5
Chloride (V)	*	*	NS	NS	*	*	*
Variety (C)	*	*	*	*	*	*	*
V x C	NS	NS	NS	NS	NS	*	NS

NS = not significant; * = significant at P<0.05
Planting Date: April 20
Harvest Date: August 7

Profitable No-till Systems Designed for Producers in the North American Great Plains and Prairies

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In an effort to save trees (and time) we have chosen to limit our remarks in these proceedings to some brief comments. The in-depth information that normally would be included is more easily and comprehensively accessed from our home page (www.dakotalakes.com). It is hoped that this approach will allow the user to tailor the information for their specific needs.

The title of this presentation "Profitable No-till Systems Designed for Producers in the North American Great Plains and Prairies" was purposely chosen rather than a title such as "Conservation Farming on the North American Great Plains and Prairies". On the surface there does not appear to be a great deal of difference between these titles. The geographic region of interest is the same. Both imply that farming practices are to be discussed. However one title uses the words "Conservation Farming". This refers to soil and water conservation. In reality, this needs to be done in order for agriculture to be a renewable industry rather than (as it predominately is now) an extractive industry such as mining, petroleum, etc. Conserving soil and water resources should be a primary goal for every producer. However, the present economic system does not directly reward a farmer for conserving the soil and water with which he works. In fact with numerous "conservation farming" techniques the opposite occurs. The producer is often faced with the decision whether to conserve the resource or maximize profit. If he doesn't do the latter, someone else will be farming his land in the future; mining the soil that he conserved. For this reason, conservation **cannot be the only goal**. Maximizing short-term profitability also cannot be the only goal if a producer hopes to remain (or have his family remain) on the land he farms.

The Dakota Lakes Research Farm has both a research and a production enterprise. The production enterprise must produce sufficient profits to fund a majority of the operational expenses of the research enterprise. For this reason, the first priority of the production enterprise is to be profitable.

This dual enterprise structure was established in 1983 in an attempt to provide an independent source of funding that was less prone to influence by special interests and politics. This required substantial change in what was then a conventional tillage based research operation. Substantial expansion in the amount of land managed was required to provide a sufficient base to operate both a production and a research enterprise. If conventional farming practices were to be used on both the production and research enterprises a large investment in machinery and manpower would be required. This did not appear to be a prudent course. Consequently, it was decided that the production enterprise would be designed to utilize the manpower available and require only minimal investment in new machinery. The plan was to accomplish this through the use of diverse crop rotations. Weak-link analysis indicated that moisture would be a limiting

factor for many of the potential rotational crops. Consequently, a key component of this plan was adoption of moisture conserving practices to allow growing of high water use crops in a region where their production was marginal with conventional tillage.

A holistic or systems approach was taken. This meant that component and technique choices were based on evaluation of how that choice would impact other components in the system. It was evident that (in 1983) there was not an adequate amount of knowledge available on the type of farming system needed for this situation. This meant that many of the component choices required to build the system could not be based directly on research data or producer's experience as is commonly done in agriculture. Consequently, many choices were based on fundamental agronomic principles using natural cycles and native vegetation as a guide. Research projects were initiated concurrently to better define components and techniques for areas where knowledge was lacking.

The present operation at the Dakota Lakes Research Farm is substantially different than what was begun in 1983. Only part of this difference is due to technological changes that have occurred in the last 17 years. A majority of the difference stems from developing a better understanding of what happens when crops are grown in a manner which places heavy emphasis on developing a healthy and biologically active soil ecology and uses cultural practices (rotation, sanitation, competition) as the primary methods of pest control.

An example of this philosophy sees weed problems as a symptom that the farming system does not contain sufficient diversity (the weed is Mother Nature's way of trying to add diversity). With conventional thinking attempts would be made to control this weed with herbicides or tillage. The systems approach adds a crop to provide the diversity that was lacking. With this philosophy, attempts are made at preventing problems by addressing the cause rather than merely treating the symptoms as they appear.

Many of the farmer practitioners of this technique refer to accepting this approach as having a "brain transplant" since it requires developing new skills and a different attitude. Most important among these is the need to realize that to be sustainable and profitable on a long-term basis the farming system must be designed such that natural cycles and principles become an ally rather than an enemy. Inputs such as fertilizers or pesticides then become methods to augment or initiate natural cycles rather than being tools designed to stop processes that are natural.

Tillage selection is a primary example of this different approach. In natural systems, **tillage is a catastrophic event** (associated with glaciers, erosion, volcanoes, etc.) that occurs only rarely. Both macro and micro fauna are profoundly impacted. Soil dwelling specie are disrupted to an even greater degree than those which can migrate to more suitable habitat. With frequent and repeated tillage, the soil ecology becomes predominated by specie that require tillage in order for residue and nutrient cycling to occur. Since tillage generally occurs prior to plant growth being initiated, nutrients have been placed in a mobile form before they are needed, making them vulnerable to loss. If

tillage is not performed, lack of aeration (caused by the poor soil structure that results from repeated tillage) causes nutrient cycling and crop growth problems. In undisturbed natural systems, nutrients and residues are cycled by a complex web of macro (grazing animals, earthworms, mites, spring tails, etc.) and micro (fungi, VAM) fauna. In this system, residues are maintained to protect the soil until new plant growth occurs. Canopy conditions created by this new growth allow residue decomposition rates to accelerate. This residue decomposition releases nutrients for use by the subsequent crop when they are needed. If this system were not properly balanced, the prairies of North America would either be desserts or hay stacks. In farming systems designed to mimic undisturbed natural systems, fertilizers are utilized to replace nutrients exported from the system and are applied in a manner to provide an early competitive advantage to the crop that is to be harvested.

This complex web does not reappear quickly when a soil that has been tilled for a number of years is managed without tillage. The soil structure and organic matter lost during the tillage period does not reappear quickly either. For this reason, initiating low-disturbance techniques requires careful planning in regard to how the transition can be made without sacrificing short-term profitability. Many of the struggles and failures associated with producers adopting low disturbance methods traces to inadequately addressing this issue.

Similar analysis can be performed in relation to the impact tillage choice will have on weed pressure, insects, diseases, etc. Nutrient and residue cycling was chosen to provide an example of the thought processes involved.

The Dakota Lakes Research Farm did not initially choose to use reduced tillage techniques because of the soil and water conservation benefits; or due to the fact that soil health and nutrient cycling would be improved; or for wildlife benefits; or for carbon sequestration potential; or any of the other benefits brought to light in the last 10 to 15 years. The decision was made on the basis of the potentially improved profitability that the moisture conservation and workload spreading characteristics provided. The ultra-low disturbance, diverse crop rotations system that has evolved also owes much to the desire to maximize the utilization efficiency of manpower and machinery resources. It has also resulted in lower pesticide use and higher yield levels than anticipated. It is believed that much of this is due to a better understanding of the use of natural cycles. It is also quite possible that soil health and soil ecology play a much greater role than has been realized in the past.

It is almost certain that no producer will utilize exactly the same system components used at the Dakota Lakes Research Farm. Their physical (soil, climate, etc.) and fiscal (machinery, capital, manpower) resources differ from ours. Their choice of components should reflect these differences. The fact that the basic laws of nature function the same independent of these differences does indicate that the "SYSTEMS" approach successfully used at the Dakota Lakes Research Farm (and more importantly by producers in this and other parts of the world) may provide insight in potential approaches to be used in developing improved farming systems.

Customizing the "SYSTEM"

The Dakota Lakes Research Farm enterprise presents a good example of how basic principles are used to create systems suited to differing physical resources. At the present time, the operation manages slightly over 1,200 acres of land. Some of this land is classed as a short-grass prairie due to the fact that it has shallow, clay, soils that limit available water holding capacity. Some of the land is short-grass prairie because of sandy soils that limit available water holding capacity. Some land is classed as mixed-grass prairie because the soils have good water holding characteristics. Some of the land is irrigated. This removes water availability as a primary constraint. Some land is close to the headquarters. Other land is as much as 40 miles away and requires moving machinery through the city and across the Missouri River Bridge in order to reach it. Some of this land has over 10 years of no-till history; some has just been acquired. Some has a history of over 50 years of wheat-fallow management with tillage; some has never been tilled since it was brought into production from native sod without tillage. Some land is owned; some land is rented. Differences in addition to these exist as well. It would be unwise to attempt to manage each of these situations with the same components. They are, however, all managed using the same approach to create a system designed to optimize the contribution that property makes to the operation. This approach is based on the application of fundamental agronomic and biological principles. **These principles do not change**.

One of these basic principles is that water utilization intensity must be **proper**. In other words the water use must match the water available. If the system is not sufficiently intense problems such as water logging, saline seep formation, nutrient loss, traffic ability problems, etc. are common. If the system is too intense, poor yields due to water stress or stand establishment problems are likely. Under irrigated conditions at Dakota Lakes the intensity of water use is limited only by the amount of growing season and heat received in the summer and by the availability of capital, manpower, and equipment to pump water from the Missouri River when it is needed. The choice to limit intensity under irrigation therefore is based on fiscal (manpower, equipment costs, energy) resources. On the dryland portion of the operation, intensity of water use is controlled by physical resources (soil type, rainfall, climate, etc.). In both cases, improper intensity results in management problems and less than optimum profitability. No-till management allows (requires) more water use by the crop (transpiration) since less water will be wasted by the direct and indirect impacts of tillage (evaporation and runoff).

Another basic principle is that diversity must be **adequate (appropriate)**. As mentioned before, lack of diversity provides an opportunity for weed and disease organisms to build to harmful levels. The cost of controlling these opportunistic specie and the capability to do so needs to be evaluated in each situation as it compares to what can be accomplished by using more diverse crop rotations. Under irrigated conditions at the Dakota Lakes Research Farm, corn (field and popcorn) and beans (edible and soybean) are the crops capable of returning the most increase in yields from the fixed costs associated with the irrigation development. If all acres were devoted only to these crops much of this

increase would be offset by increased variable costs (pesticides), reduced efficiency in use of fixed machinery resources, and reduced yields. In addition, energy costs would rise on both a per acre and per unit of production basis. Some of this is caused by lower yields but most is due to a reduction in electricity price if the supplier is allowed to control (turn off) the irrigation pumps during periods of peak electrical demand. By devoting part of the acreage to rotational crops which do not share the same peak water use characteristics as corn and beans this can be done without limiting the ability to supply all crops with their full water needs. Consequently, on the irrigated portion of the operation, adding diversity has more impact in reducing variable costs than on reducing fixed costs although both are benefited. Conversely, on the dryland portion of the operation adding diversity provides the most benefit to reducing fixed costs (land, family labor, and machinery) per unit of production (not necessarily per acre). Variable costs are also reduced dramatically (especially pesticide inputs) once the system is in place and working properly. This may not be true during transition periods. Seed and fertilizer costs change very little on a per unit of production basis.

The bottom line of this approach is to view each farming operation as unique. The goal is to optimize the utilization of the resources (land, labor, capital, and machinery) available to that operation in a profitable and environmentally compatible manner. This requires devising a unique system for each operation, owner, parcel of land (and even portions of a piece of property), etc. rather than attempting to devise a farming recipe that fits all fields of all producers in all situations.

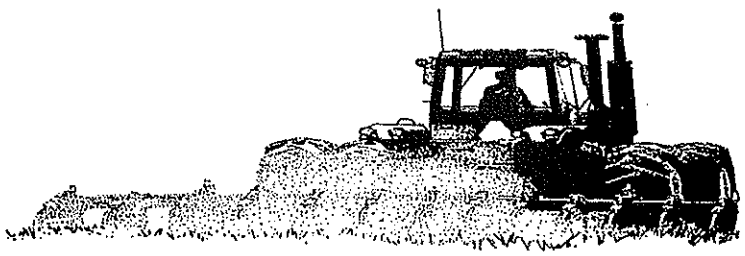
Common Characteristics

This is not meant to imply that there are no common characteristics amongst the most successful no-till systems being used at Dakota Lakes and by real producers throughout the plains and prairies. Foremost among these is the inclusion of three or four crop types (cool-season grass, cool-season broadleaf, warm-season grass, and warm-season broadleaf) in the rotations used. Where cool-season crops are traditionally grown, addition of the warm-season grass component provides more benefit (adds more diversity) that adding a warm-season broadleaf because of the commonality of some diseases (such as white mold) and herbicide programs among warm and cool-season broadleaf crops. Rotations that are not consistent in terms of either **interval or sequence** provide the best protection against species shifts and biotype resistance. In other words rotations such as wheat-canola or wheat-canola-wheat-pea are consistent in both interval and sequence. Wheat always occurs in alternate years and always follows a cool-season broadleaf. Rotations such as s.wheat-w.wheat-pea-corn-millet-sunflower are not consistent in either interval or sequence. Rotations should have crop type to crop type intervals of a minimum of two years somewhere in the rotation. Extended perennial phases (grass seed, alfalfa) minimize agronomic problems associated with the low diversity rotations in the annual cropping portion of the rotation. This approach is useful in some situations but does not normally lead to optimization of machinery and labor resources. Perennial sequences are an excellent way to "jump start" the system. Another trend that is obvious especially in the Dakotas, Kansas, Nebraska, and Colorado is a move to the use of lower disturbance techniques as rotations improve. This trend is

stymied at times by limited choices in seeders that have the capability to properly place fertilizer while accurately seeding with low-disturbance. Dormant seeding of spring cereals (especially wheat) has become a predominant practice for many producers. This technique shifts workload from the busiest time of the year to a non busy time. When this is properly done, benefits for many operations far outweigh the risks. Dormant seeding of canola is not as well proven and consequently is not as widely employed. Producers in higher rainfall areas and those with irrigation are beginning to utilize cover crops as a means of adding diversity and intensity to their systems.

Wrapping it up

Soil and water conservation are a consequence or side benefit of utilizing properly designed no-till systems. Sustainable profitability must be the primary goal in order to assure that conservation continues long-term. The best systems attempt to mimic native vegetation in terms of intensity (water use) and employ as much diversity as needed to to optimize the system. Each resource (land, machinery, labor, etc.) is managed to optimize its contribution to the operation without overtaxing its capability. More in depth information on these subjects can be found at the dakotalakes.com web site and related pages. Of specific interest would be "No-Till Guidelines".



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